Planning Informations

Façades, Interior design, and Balconies

with fibre cement

creaboard®

...individual design solutions - Made in Germany

creaboard®

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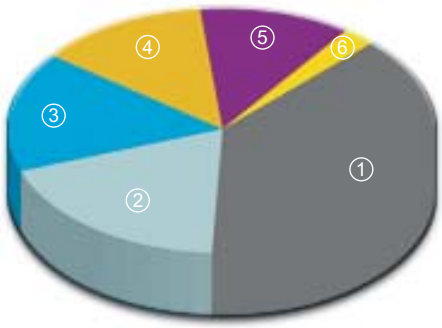
Information on Material

Fibre cement, by fibres reinforced material, consists of natural and environmentally friendly substances. Its positive features fulfill current needs in construction design. The tried and tested technology is basing on more than 20 years in development, practical use, as well many years of experience by installations in buildings. Large-size fibre cement panels withstanding high climatic loads, are reliable to be the ideal solution for ventilated curtain walls. The highly compressed, with fibres reinforced material is non-combustible and, as soon as has been hardened, weather-resistant and keeps its shape. It also possesses further latent advantages: For instance, it behaves absolutely neutrally against electromagnetic waves and radiation. So radio waves, scanning systems, infrared devices and radar beams remain uneffected. Industrially applied coating on the panel means almost unlimited freedom for design and ensures constant high quality of *creaboard* fibre cement panels. They are UV and light resistant. The rear side of the panel is equipped with a protective sealing. The large-size fibre cement panels are manufactured acc. to regulations of EN 12467 norm. It is audited by material tests and permanent internal factory production control. *creaboard* fibre cement panels has been tested acc. to EN 13501-1 and classified as A2-s1,d0. Fibre cement panels are environmental safe products without any danger to health.

Portland cement as binder has the largest share in this material. Material properties are optimized by adding e.g. limestone dust and recycled fibre cement. Fibre cement is reinforced by synthetic organic polyvinyl-alcohol fibres ensuring required bending strength. Such fibres are similarly used in textiles for clothes, protective fabrics and medical threads.
An important point is that the fibres are physiologically harmless. During manufacturing, mostly cellulose fibres are the important process fibres, similarly to paper production processes.

A ready panel also contains air in microscopically small pores. So due to microporous system, an easy-to-use construction material is created that is breathable, humidity-controlling and frost-resistant.



① Binder ~ 38,5%
② Air ~ 18,5%
③ Water ~ 16%
④ Process fibres ~ 13%
⑤ Additives ~ 11,5%
⑥ Reinforcing fibres ~ 2,5%

Material Properties

Besides ideal static properties, coated *creaboard* fibre cement panels also possess following ones:

- **non-combustible (A2-s1, d0 acc. to EN 13501-1)**
- **weather- and frost-resistant**
- **waterproof**
- **rot-proof**
- **tough and impact-resistant**
- **easy to mount**
- **UV- and weather-resistant**

Area of Application

creaboard fibre cement panels unify a maximum standard of design and technique. Besides modern appearance, they are very durable, easy to clean and provide wide design-freedom for e.g.

- **ventilated curtain walls**
- **interior desings**
- **balcony cladding**
- **weatherboarding**
- **lining of window reveals, as well as window and door lintels**
- **filling of mullion-transom façades**
- **eaves**

Panel thickness - 8mm
for standard constructions of wall claddings in interior and exterior area, on aluminium- or timber- substructures. To fix on timber-substructures by stainless steel facade screws, or on aluminium substructures by colored aluminium façade rivets.

It is very importnant to mount the panels tension-free. For this reason, drill holes in the panels must be made larger than shaft diameters of fastening means. >p. 11+18

Panel thickness - 10mm
Panels coated double-sided are used for non-combustible balcony claddings for all types of buildings of any height. Area of application includes e.g.
partition walls, railings, sun-protection panels and other items, as well.

Panel thickeness - 12mm
concealed fastening by undercut anchors from the reverse side. >P. 34

Advantages

creaboard fibre cement panels allow you to put creative ideas into practice easily and attractively. An almost unlimited range of colors and effects, as well as sizes means a huge designing potential. Each project is unique, and there are numerous design options and diverse surface effects, as well as possibility to combine them individually to fulfill your custom desires.

There are no restricted color charts with limited choice. The desired design is produced with relation to a project. Depending on the variant, it particularly means following:
- **individual design**
- **huge designing potential**
- **edge coating ex factory is possible**
- **maximal optimization = minimal costs**
- **efficient manufacturing and short delivery time**
- **panels are "read to use" on site**

Besides variety of colors and surfaces, diverse panel sizes and their positions (horizontal, vertical and weatherboarding) contribute to design freedom.

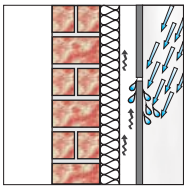
Exclusivity guaranteed - worldwide
Of course, options and effects can be developed individually. Upon the customer's request, it is possible to protect it against purchase order by third parties. Only the specially registered owner can authorize the manufacturing.

Principle: Ventilated Curtain Walls (VCW)

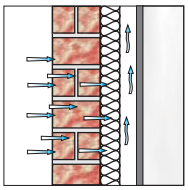
Definition:
„Skin mechanically connected with the space-enclosing wall and ventilated across its entire rear surface for constructional physical reasons.“
Using creaboard fibre cement panels in ventilated curtain walls means a variety of options for façade designing.

Thanks to selected colors, effects, surface, shape, sizes, joints pattern and panel fixing means, a façade becomes an attractive "business card". Due to constructional separation of heat insulation and weather-resistant barrier, ventilated curtain walls are high-efficient systems. That is achieved by constructional separation of the façade cladding from substructure and insulation. Due their cost-effectiveness, ecology, durability and comfort, ventilated curtain walls gain in importance in new buildings and reconstruction. The principle of ventilated curtain walls offers a number of constructional physical advantages providing the highest living comfort.

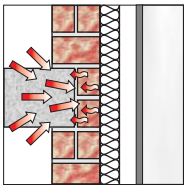
Weather Protection
Thanks to physical properties, thermal insulation layers are protected against capillary water-transfer and direct rain water. Humidity can be always carried off via the ventilation space, and the wetted insulation layers can quickly dry again, without diminishing thermal insulation. The separation of cladding from substructure and insulation provides an additional weather-resistant barrier.



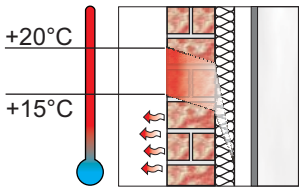
Condensation Protection
Condensation protection is an important prerequisite of an exterior wall's thermal insulation. Ventilated curtain walls allow installation with correct constructional physical properties where vapor diffusion resistance decreases from inner layer to outer layer. At least 20mm ventilation space between the insulation and cladding prevents heat accumulation, carries off humidity upwards and controls condensate balance of the building. So the insulation and walls remain dry and functional.



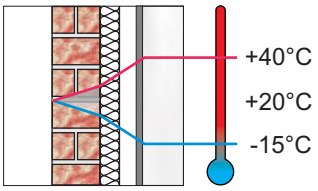
Thermal Bridges
Especially in old buildings, expensive thermal-energy is lost by poorly insulated joints in external walls. These weak points can be closed by an uninterrupted insulation layer.



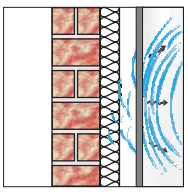
Heat Retention
The insulation attached on the external wall keeps warmth in the masonry and thereby utilizes heat storing capacity of the material. That creates thermal comfort inside the building and saves heating costs. In addition, mineral insulation supports the fire protection.



Temperature Equalization
Any desired insulation thickness is possibble. In this way, the properly insulated façade will not be influenced by large temperature fluctuations. In summer the outer masonry is not heated, because of the majority of solar radiation is reflected by the façade panels. In winter, cooling down of masonry is strongly reduced by the insulation layer. In this way, indoor climate remains balanced all the year. That means economical and as well health advantages.



Sound Insulation
Curtain walls provides additional protection against noise. The most part of sound waves is reflected by the façade surface, and the remnant is damped by insulation material. So noise load can be reduced by ~ 10 dB.



Environmental Friendliness
Fibre cement consists of natural raw materials that are ecologically and hygienically absolutely safe. The possibility of complete recycling of all components matters more and more, as well. All components of aluminum or wood structures, insulation and facing can be separately recycled.

Ventilated curtain walls as a vapor-permeable structure, revetted with fibre cement, provides technical and functional safety and has proved its value since many years. By a ventilated curtain wall, it's easy to install insulation of any needed thickness. That is why it is also called “energy facade”. A substructure of metal or timber creates the static connection between cladding and anchoring. creaboard fibre cement panels are manufactured in many various versions and feature a reliable weather resistance. The possibility to compensate structure tolerances as well a montage independent of weather, is a particularly large advantage in restoration. Other characteristics of the system are long life-cycle and low vulnerability. Acc. to the German Federal Construction Ministry, ventilated curtain walls have the lowest damage rate among all façade systems since many years. Its report show that single-shell wall structures have higher loss frequency than bivalve ones with a layer of air.

Panel Properties / Tolerances

Standard panels are supplied with punched edges, as shown in illustrations. Panels with punched edges must be trimmed approx. 15mm on all sides before being used. For net sizes see following table.

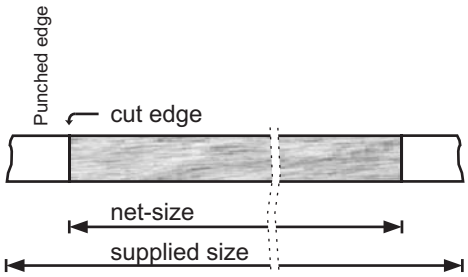
Surface

To integrate the fibre cement characteristic into the surface, is often desired by investors and architects. This effect is achieved by such designs e.g.: Lasura, Naturalis, or Ligno *-natural*. Inhomogeneities, varying hues and traces of the manufacturing process contribute to this specific appearance. This "living" design is attended with the fact that changes of the base panel are also visible on its surface. Humidity can penetrate in trimmed edges and in drill holes and cause these areas to look darker. Because of wet weather, humidity can cause on such non-covering coatings a darker hue at edges and at drill holes. Depending on the weather within the year cycle, this occurrence diminishes, if the weather is dry.

Edge Sealing

To reduce the „edge effect" and achieve an ideal overall appearance, the edges have to be protected with the *creaboard* edge sealant > p.9

Depending on the design version, it is possible to order the panels with coated edges at the factory and eliminate the need of sealing them on site.



raw thickness (mm) ± 10%	size incl. punched edges length (mm)	size incl. punched edges width (mm)	net-size incl. punched edges length (mm)	net-size incl. punched edges width (mm)
8	3130 ± 12	1280 ± 6	3100	1250
8	2530 ± 12	1280 ± 6	2500	1250
10	3130 ± 12	1280 ± 6	3100	1250
10	2530 ± 12	1280 ± 6	2500	1250
12	3130 ± 12	1280 ± 6	3100	1250
12	2530 ± 12	1280 ± 6	2500	1250

Technical Data

Building Materials Class	non-combustible; A2-s1,d0 (EN 13501-1)
Density	≥ 1.65 g/cm³
Bending Strength	∥ 17 N/mm²
Fracture Point	⊥ 24 N/mm²
Compressive strength	50 N/mm²
Modulus of Elasticity	approx. 15000 N/mm²
Thermal Conductivity	λ = approx. 0.6 W/mK
Thermal Endurance	up to 80°C
Temperature Coefficient of Extension (TCE)	α_t = 0.01 mm/mK
Moisture Content at Delivery	~ 6%
Water Absorbing Capacity	≤ 20%
Coefficient of Moisture Extension	1.0 mm/m (air-dry - wet)
Frost Resistance	yes (DIN 52104)

Calculation Values

The values alongside, are to be used to calculate a structure.

creaboard fibre cement panels	permanent load kN/m²	modulus of elasticity MN/m²	permissible bending stress MN/m²	TCE $10^{-6}K^{-1}$
8 mm	0.18	15000	6.0	10
10 mm	0.23	15000	6.0	10
12 mm	0.28	15000	6.0	10

An overview of permissible stresses, as well as for *creaboard* fastener material whose use is required for warranty.

Fasteners	Ra_{min}	permissible lateral force kN	permissible tensile force kN centre	permissible tensile force kN edges
Façade rivet, colored 4 x 18-K15 mm ; d = 8 mm 4 x 25-K15 mm ; d = 12 mm	≥30 mm	0.82	0.67	0.56 Fs_{min} ≥ 1.8mm
Façade screw, colored 5.5 x 35 mm ; d = 8 mm 5.5 x 45 mm ; d = 12 mm	≥20 mm	0.33	0.32	0.30

d = material thickness of fibre cement panel
Ra_{min} = minimum distance of the drill hole to the edge, in right angle to the substructure, edge distance in direction of the profile, or batten is 80 - 160 mm
Fs_{min} = minimum thickness of the aluminium profile flange

Requirements in Building Physics

The complete exterior wall and exterior wall cladding system should be considered for moisture-, thermal-, fire- protection and sound insulation. Ventilation is necessary for reliable transporting of the building moisture and condensate on the panel rear side, possibly penetrating rainwater as well as capillary separation of the wall surface or thermal insulation from the cladding material. The distance between the cladding and wall/thermal insulation must be minimum 20mm. The distance can be locally reduced up to 5 mm, e.g. by the substructure or wall non-flatness.

Ventilation and deaeration openings with cross-sections of minimum 50 cm² per 1 m wall length must be provided for a long-term and reliable functioning of the façade.

Constructive Requirements

The façade panels have to be mounted without tensions. Ensure that no damages at cladding or substructure, caused by tensions or material expansion, can occur.
Tension-free fixing of façade panels is achieved, when all holes in the panel are drilled larger than diameters of fasteners. On aluminium substructures prepare two fixed points per each panel by using of fixed point sleeves. > p. 11
In the area of expansion joints of the building, the same movements must be possible in the substructure and in the cladding. That is also valid for expansion joints in the substructure. > p. 12

To avoid displacement tensions caused by coupling of individual panels over profile joints, joints of the profiles must not lie between fixing points of a panel.
> p. 12
The minium edge distances of the drill holes in the panels must be observed. > p. 11+18
Insulation materials must be mounted without gaps, stable and permanently. Possible moisture loads caused by weather must be taken into consideration.
Wooden materials must be protected acc. to DIN 68800-1,-2,-3, and 5 > p. 16
Avoid lasting penetration of moisture into vertical timber battens.

Open joints near timber battens must be protected with waterproof strips between the battens and the fibre cement panels. >p. 18
Constructive measures and selection of suitable building materials must ensure that any damaging influence of one material on another (also without direct contact, especially in water flow direction) is avoided.

To allow for façade maintenance, provide anchoring for scaffolding. When mounting, respect geometric suppositions of static calculation and final planning.

Static Stability

Static stability of the façade must be proved. For compensation of external wall dimension tolerances, at least 20mm must be added to the designed distance between the external wall and cladding. If dimension deviations detected on site are smaller, it can be omitted. Deformations must not diminish the façade cladding functionality. Calculation values of the permanent load, of the permissible bending stresses, and modulus of elasticity, as well as of the temperature coefficient of extension of the fibre cement panels and permissible stresses of fasteners, see the relevant tables.>p. 5

Stability against wind loads for closed prismatic structures must be tested and proved for all façade cladding parts, acc. to DIN 1055-4. Thereby the panels must not carry additional loads, e.g. of components for advertisement or window devices. If main and auxiliary loads are differentiable, the static proof of façade stability must be based on the permanent load and wind load as the main load. In edge areas of buildings with ventilated curtain walls, increased wind suction loads acc. DIN 1055-4 need not be con-sidered, if façade cladding is air-permeable acc. to DIN 18516-1, e.g. due to open joints between the cladding elements. > p. 13
All façade cladding parts must be calculated with securities or permissible stresses defined in the applicable norms. Load-bearing capacity of fixing materials and connections must be proved. Dowels, anchoring rails, etc for anchoring of the substructure in the external wall are permitted for use, only if their usability is proved.
The regulations described above are valid in Germany. In other countries, please respect national regulations and specifications.

German regulations, each in its latest edition**:**

DIN 1052-1-4	Wooden Structures
DIN 1055-4	Loads for Buildings; Traffic Loads, Wind-Loads at Structures which are not susceptible to vibrations
DIN 1745-1	Strips and Sheets of Aluminium and Aluminium alloy, Thicknesses over 0.35 mm; Properties
DIN 18202	Tolerances in Building Engineering; Structures
DIN 18516-1	External Wall Claddings, ventilated; Requirements, Test Standards
DIN 4074-1	Grading of Wood acc. load capacity - Part 1: Coniferous Trimmed Timber
DIN 4108-3	Thermal Insulation in Building Engineering; Protection against Moisture subject to Climate Conditions; Requirements and Directions for Design and Construction
DIN 4109	Ssound Insulation in Buildings; Requirements and Testing
DIN 4113-1	Aluminium Constructions under Predominantly Static Loads
DIN 52210	Testing of Acoustics in Buildings; Air- and Impact Noise Insulation
DIN 68800-1,-2,-3 & -5	Wood Preservation in Buildings
DIN EN 12467	Fibre Cement Sheets; Product Specification and Test Methods
DIN EN 13162	Thermal Insulation Products for Buildings
DIN EN 13501-1	Fire Classification of Construction Products and Building Elements
DIN V ENV 61024-1	Lightning Protection of Buildings, General Principles
Rules	Rules of Covering with Fibre Cement -Part 2; External Wall Cladding, The German Confederation of Roofer
VOB Part C, ATV DIN 18351	Contracts Procedures for Buildings Works - Part C: General Technical Specifications in Construction Contracts (ATV) - Façade Works

We don't bear responsibility for completeness of list above. When planning and mounting, please always respect valid national regulations.

Thermal Insulation / Insulation Materials

The constructional thermal insulation protects buildings from thermal extremes and moisture. A good thermal insulation contributes to health and comfort of persons, increases the life-cycle of buildings, and in addition it saves energy resources. The structural principle of ventilated curtain walls allows a weather-independent mounting of mineral insulation of almost any thickness, at any season, so it provides a special contribution to energy saving.

Insulation
For thermal insulation of the ventilated curtain walls, mineral insulation materials should be used acc. to DIN EN 13162 type WAB T3 WL(P), thermal conductivity group 035 (0.035 W/[m*K]), or 040 (0.040 W/[m*K]). Usually insulation of approx. 120-140mm thickness is used. Insulation panels should be mounted without joints, displaced to another and without cavities between the wall and the insulation layer. On average, they have to be mechanically fixed by 5 insulation holders per 1m² and tightly jointed to the adjacent components. „Deutsche Rockwool Mineralwoll GmbH“ (www.rockwool.de) and “Saint-Gobain Isover G+H“ (www.isover.de) also offers approved façade insulation panels that can be fixed by 2 insulation holder per each panel. That makes about 3 holders per 1 m².

Fire Protection

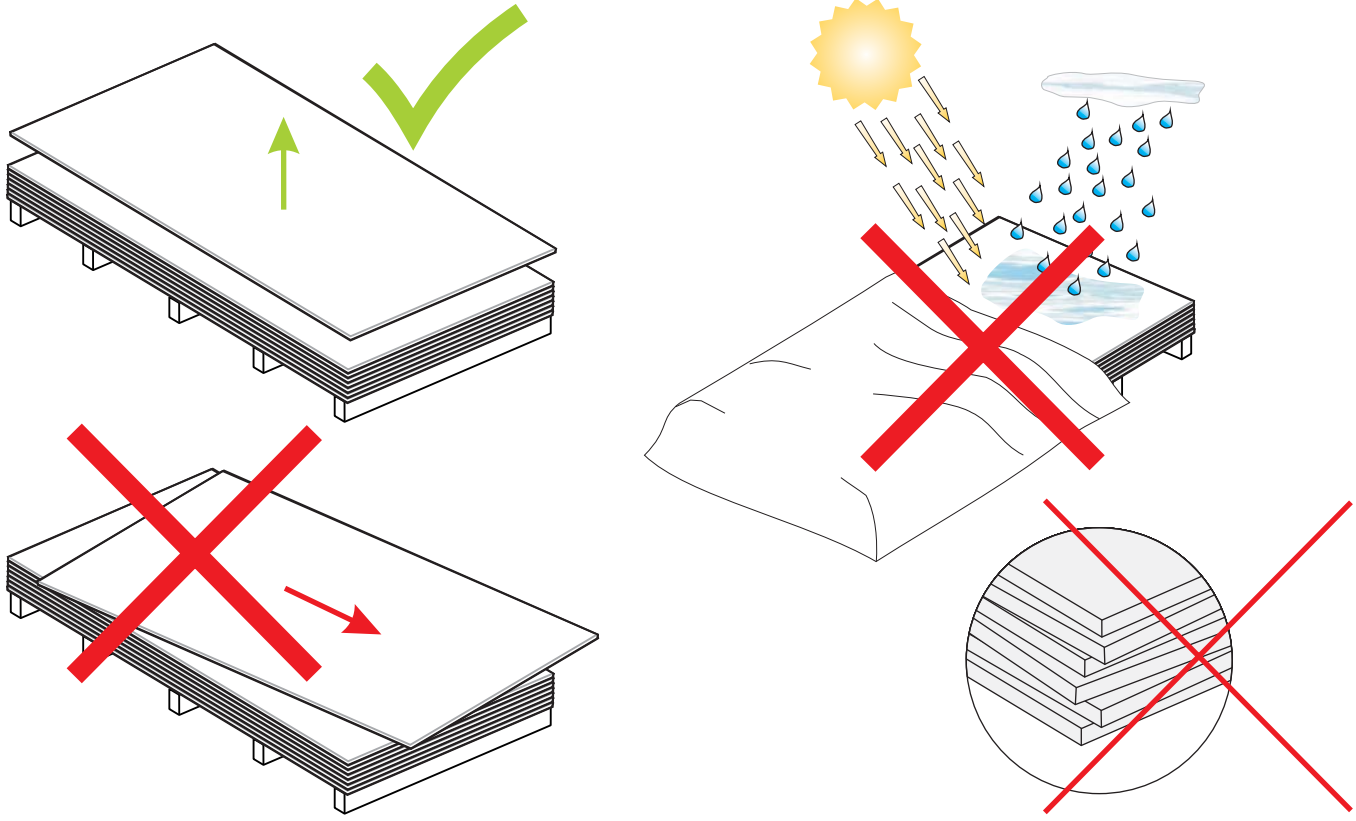
Fibre cement is non-combustible, it does not melt and releases no hazardous smoke gases in the case of fire. That is why the ventilated curtain walls with fibre cement panels belong to the safest external wall structures. Fibre cement façade panels can be used for VCW in any type of building of any height. *creaboard* fibre cement panels belong to non-combustible building materials (A2-s1,d0). As substructure for cladding with non-combustible fibre cement façade panels (building material class A2), at least normal-flammable building materials (building material class B2) must be used in building engineering. So there is usually no objection against use of substructures made of wood. Observe national regulations.

The Property Insurers Association estimates the risk of fire expansion through ventilated façade as low, if the cladding and the insulation layer consist of non-combustible building materials.

For high buildings and buildings of special kind and use, usually non-combustible materials are prescribed.

Transportation and Storage

The fibre cement panels should be stored and transported on even and dry pallet, lying on its entire surface and protected against moisture and sunlight. The fleece between panels protects the high-quality coating and must be used when the panels are piled up again. The panels must be piled up carefully. Pile only so many panels one above the other that the number of them on a pallet does not exceed the delivered quantity/pallet and the surface can't be damaged. Store the panels so that the colored side is opposite the colored side of another panel. Use the fleece between them. Transportation package does not provide any protection against rain. The panels must be protected by cover sheeting, or similar, against moisture and contamination until its mounting. If the panels are stored longer than 2 months, pile them with an air interstice to avoid damage by moisture. Always lift the panel up from the pile and never draw it off! Transport single panels only on the higher edge, do not put it on its corners.



Cleaning

Fibre cement dust caused e.g. by processing, drilling and sawing must be immediately removed from the surface. For fibre cement dust removal, microfiber dusters are ideally suitable. Final cleaning of the façade is better to do with water and sponge during scaffold dismantling. For this purpose, usual commercial detergents can be used. Use only detergents and devices which cannot cause any damage of the coating. Ask the supplier of the detergents, whether it is suitable for this purpose. Pressure washers can be used at a reduced pressure. For graffiti removal from surfaces with *creaboard* permanent anti-graffiti protection, follow to instructions of the corresponding special cleaner.

Processing on Stationary Machines

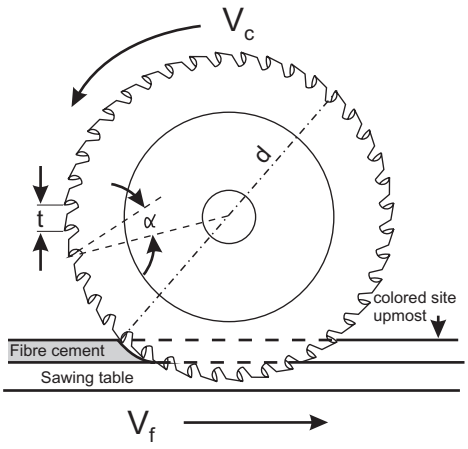
When processing fibre cement panels, understand following informations as recommended values. The data are based on our experience. For an optimal cutting quality and service life of saw blades, these must be adapted to individual conditions and the machine type.
Process the fibre cement panels only by dry cuts. Silicium carbid grinding discs and diamant cutting discs are not allowed to use for this purpose.
These both disc types require high cutting speed. That causes high cutting pressure that may lead to above-average stresses on material in the area of edges.

As well the large dust quantities and strong noise resulting from that is also a reason why these discs are not allowed for use.

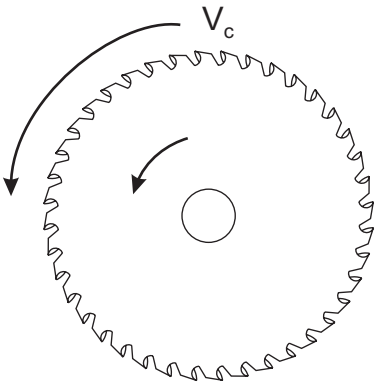
Saw blade types:
Diamond or carbide-tipped saw blades are ideally suitable. A consultation by the saw blade supplier is recommended.

Cutting speed:
60 m/s for diamond saw blade
2-2.5m/s for carbide saw blade

Feeding speed:
20 m/min for diamond saw blade
3.0-3.5 m/min for saw blade



Cutting Speed



The cutting speed, V_c is calculated as follows:

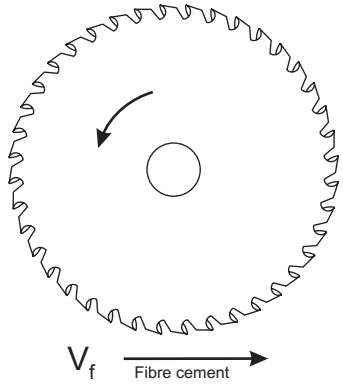
$$V_c = \frac{d \cdot \pi \cdot n}{1000 \cdot 60} \quad m/s$$

= 60 m/s for diamond saw blade
= 2.0 - 2.5 m/s for carbide saw blade

n = rotational speed of the drive shaft (min^{-1})
d = saw blade diameter (380mm)
π = 3.14

$$n = \frac{V_c \cdot 1000 \cdot 60}{d \cdot \pi} \quad min^{-1}$$

Feeding Speed



The feeding speed V_f is calculated as follows:

$$V_f = \frac{f_z \cdot z \cdot n}{1000} \quad m/min$$

= 20 m/min for diamond saw blade
= 3.0 - 3.5 m/min for carbide saw blade

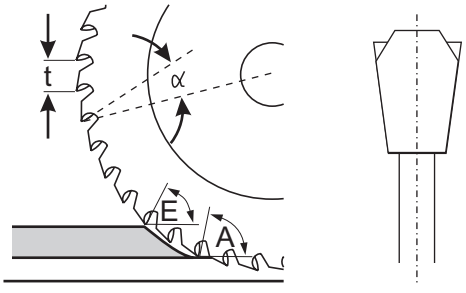
The feeding speed is to be individually adapted depending on the material

f_z = feed per tooth (mm)
z = number of teeth
n = rotational speed of the drive shaft (min^{-1})

Please note: f_z = 0.3 - 0.35 mm

Cutting direction of the saw blade is synchronous with the feed direction.

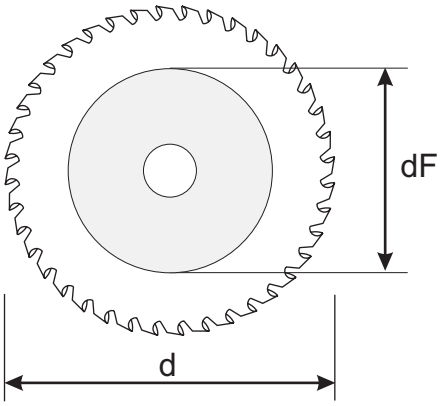
Cutting Quality



Run-out accuracy: ±0.1 mm

To achieve split-free cuts, the saw blade should not protrude more than 5mm. A lower difference between the entry angle (E) and exit angle (A) of the teeth on the panel, as well as the front rake angle of the tooth (α) considerably influence the cutting quality.
Triple-chip-flat teeth saw blades with 5° front rake angle are the best suitable. The tooth spacing (t) should not be smaller than 10mm in this case.

To avoid vibration damages, the flange diameter (dF) should be 2/3 of the saw blade diamter (d).



Processing at Site

Fibre cement panels can be delivered to the site ready-to-mount. In some cases, only some fitting cuts need to be made on site. For this purpose, suitable machines, such as slowly running manual circular saws or bench saws, equipped with suitable saw blades with effective dust suction should be used. Angle grinders with silicium carbid grinding discs or diamond cutting discs are not allowed!

Rivet Devices

GESIPA “Accubird”

GESIPA “HN-2”

GESIPA “manual rivet plier”

Saws

festool- cut-off saw AXT 50 LA

mafell- cut-off saw, PSS 3100 SE

Vacuum Cleaners

Special vacuum cleaner SRM 45
approved for dust classes M and H

Jigsaw

Recommended saw blades:
Bosch “T 141 HM“ / festool “HM 75/4,5”

Please note:
Cut fibre cement without pendulum setup

The machines mentioned above are only an overview and no guarantee of product properties. For more information on use of devices, it is recommended to contact the manufacturer. For addresses of the manufacturers, see the list on page 39

Edge Protection

We recommend to chamfer the panel edges after cutting. Use a sanding block with sandpaper (grit 80). This method reduces the risk of surface damages and achieves an accurate appearance of edges. At non-covering coatings (e.g. Lasura), when wet weather, moisture can cause dark hues on panel edges and drill holes. >p. 5
For ideal appearance, these area should be sealed with creaboard „Edge Sealant". That is also applicable for processing on site.

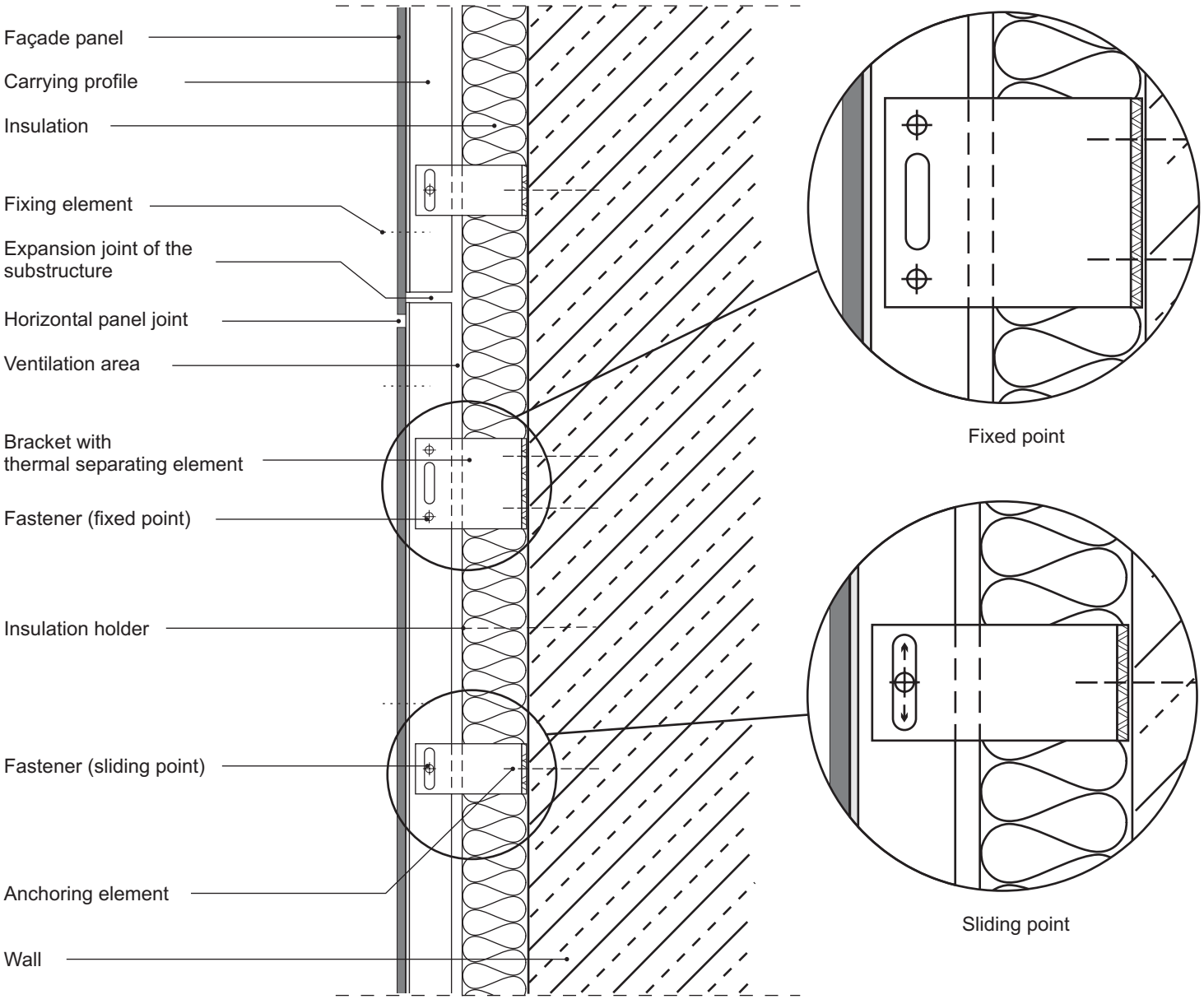
Directions for use:

- chamfer the edges and remove dust
- apply the sealant with a fine-pored edge roller, let it dry and apply it once more
- immediately remove excessive sealant from the visible side
- apply only at temperatures from +5° to +25°C

General

Aluminium substructures have shown the best performance in the practice and has got some advantages in mounting. Various insulation thicknesses or compensation of building dimension tolerances can be done easily. Official regulations on constructional fire protection must be respected too. For new buildings and renovation of façades, various aluminium substructures are offered to hold the cladding. Their static stability can usually be proved mathematically based on existing technical construction rules. Fixing of the façade panels on the aluminium substructure is to be done by rivets. The significant components of this structure are insulation with insulation holder, bracket, carrying profiles, cladding and fixing elements. Using of thermal separation elements between the wall and the brackets reduce thermal bridge effect. For anchoring the brackets, approved combinations of dowels/anchors should be used. Number, position and dimensions are to be taken from the project documentation. To allow thermal expansion and other building components movements, also sliding points (oblong holes) in profiles must be provided besides the fixed ones. That enables a tension-free mounting. Shearing loads, especially the maximal bending torques and bearings reactions must be calculated in the static stability proof of the large size façade panels. The aluminium substructure flexibility must be statically observed. In the case of „wind pressure“ load, the substructure is carrying generally the load linearly. In case of „wind suction“ load, the panels rest on bearing rings formed by rivet- or screw heads.

Construction Principle



Advantages of an Aluminium Substructure

- non-combustible
- suitable for each building height
- simple compensation of building tolerances
- simple installation of desired insulation thickness

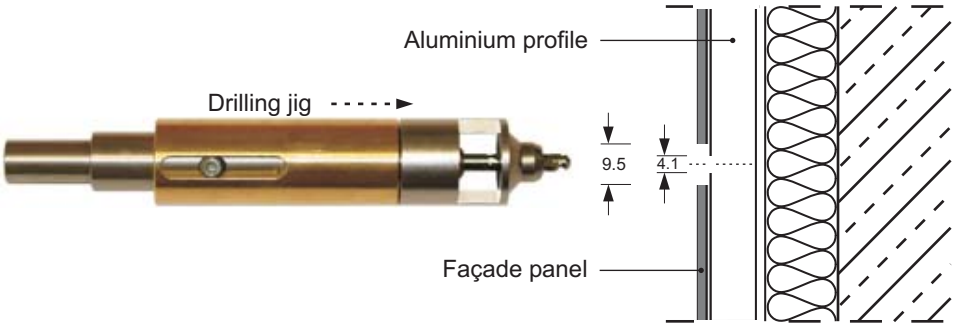
Fixing

For fixing *creaboard* fibre cement panels aluminium blind rivets with colored flat round head are used. Using uncoated heads can cause irreversible damage of the panel surface. For performing fixed points, fixed point sleeves are additionally used.

For mounting panels of different thicknesses, rivets of corresponding sizes are available.

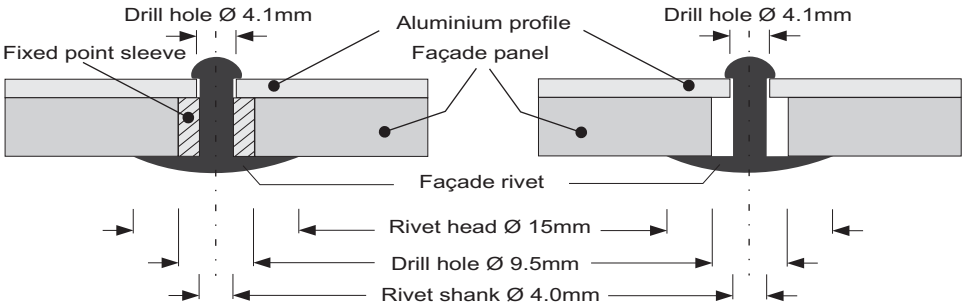
Façade rivets, colored

4 x 18-K15 mm ; 8 mm panel
4 x 25-K15 mm ; 12 mm panel



An accurate fixing pattern is to be achieved by millimeter-exact pre-drilling of the panel. For fixing by rivets, all holes are drilled with 9.5mm diameter. When mounting the façade panel, ensure that the façade rivets are set in the center.

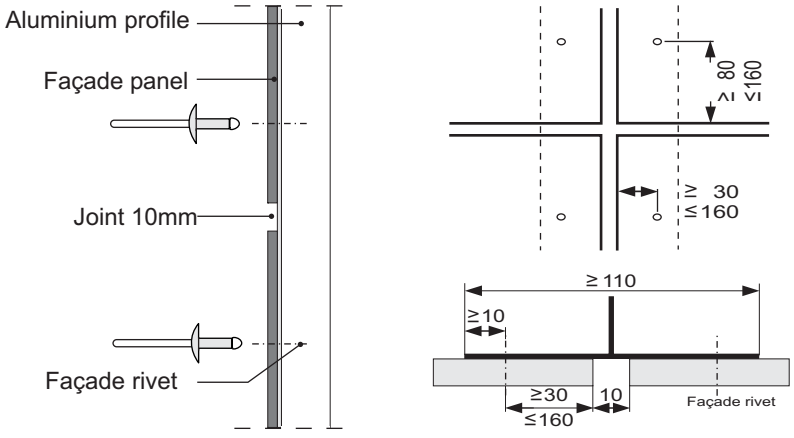
Drilling of centered holes (Ø 4.1mm) in the aluminium structure is achieved by using a drilling jig. See the left illustration.
For pre-drilling the lying façade panel on site (do not drill it on the substructure), it is recommended to use a special drill for fibre cement, Ø 9.5 mm.
Use a step drill only, if the holes cannot be pre-drilled into the fibre cement panels.
The drilled façade panels are to be mounted onto the aluminium substructure with fixed and sliding points. Two fixed points must be made per each façade panel by fixed point sleeves. They ensure an exact and tension-free positioning of the façade panel on the aluminium-substructure.



Fixed point with fixed point sleeve

Sliding point

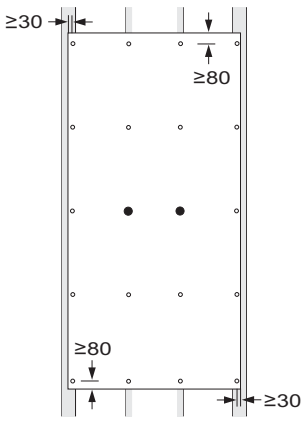
Minimum Edge Distances



The distances to edges must be not below 80mm in the aluminium carrying-profile direction and 30 mm across the profile. Edge distances exceeding 160mm should not be made. In special cases, e.g. above the lintel, edge distances up to 200mm are allowed. In edge distances more than 160mm, small differences between levels of adjacent panels can occur. However, it does not diminishes the static stability.

Using of black-coated aluminium profiles helps to avoid undesired reflections in joints.

Position of Fixed Points



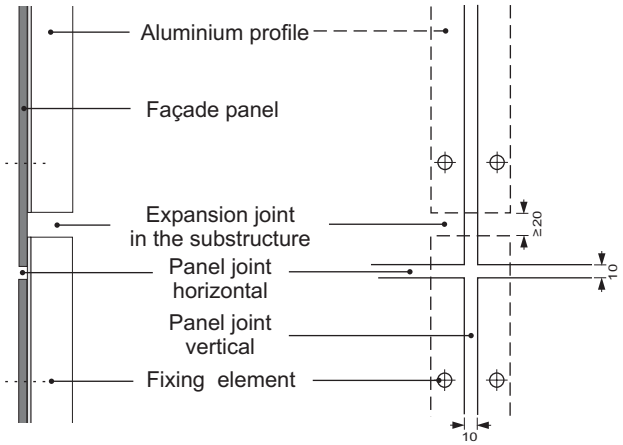
The two fixed points ensure exact and tension-free positioning of the panel on the aluminum substructure. For each panel, two fixed points must be mounted together with fixed point sleeves.
It is not allowed to place two fixed points on the same substructure profile (exception: weatherboarding with horizontal carrying profiles).

The result is a fixed point position in a 90° angle to the supporting profile direction. As far as possible, the fixed points must be placed in the panel center. If possible, each fixed point is set from the right (outside) and left (outside) onto the second carrying profile (inside).

Setting of Façade Rivets

creaboard façade rivets are to be set without rivet-setting-jig. That applies to fixed and sliding points. When a fixed point is formed, the *creaboard* façade rivet is set together with the fixed point sleeve in a single operation. The nosepiece and the clamping jaw must be selected so that any damage of the rivet head surface is excepted. The rivet head must be flat on the façade panel. A joint-exact fixing of the façade panel is only ensured by two fixed and minimum two sliding points. All sliding points are made without fixed point sleeves.
> p. 11

Mounting in Expansion Joints Area



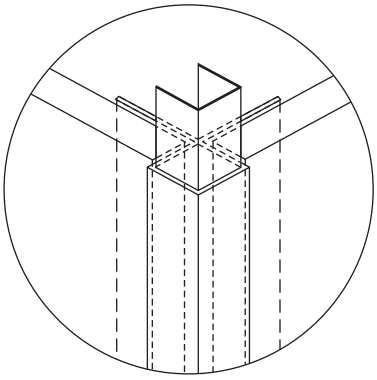
In the area of expansion joints in the substructure, the same movements must be possible in the cladding, as well.

Coupling of individual panels via the carrying aluminium-profile causes damaging tensions. To avoid these tensions, no profile joints between fixing points of one panel are allowed.

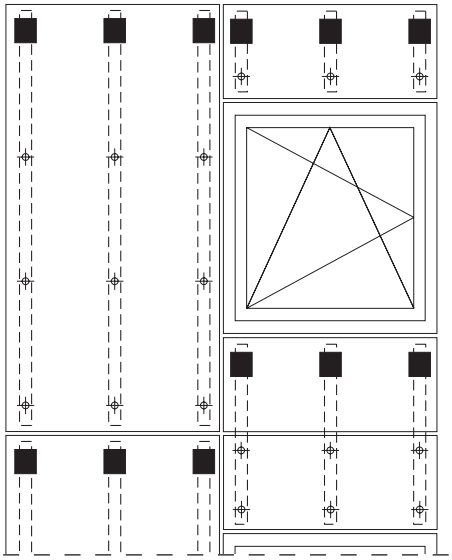
The carrying profile of the substructure must be aligned so that the façade panels are lying at the same level and can be fixed without tensions.

The optimal joint width for large-size façade panels is 10mm. By this size, both attractive and harmonic joint pattern and a technically properly function of façade is ensured.

Joint width below 8mm are not allowed. Open joints of widths exceeding 12mm should not be done.



At corner profiles, the same coupling-free expansion joints must be ensured as in the substructure.



At the same time, a panel can be fastened only onto the profiles, whose fixed points are situated at the same height. That means that e.g. profiles must be divided at window parapets, to avoid profile joints under the panel.

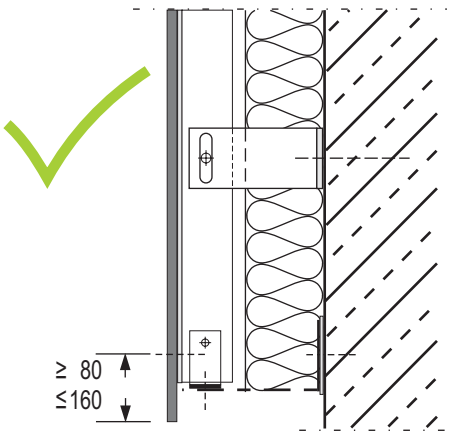
Profile length ~ storey height

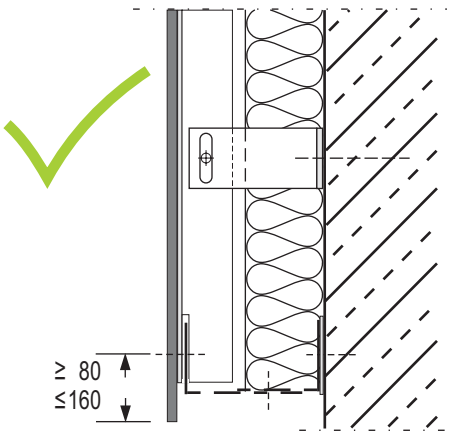
■ = fixed point, substructure

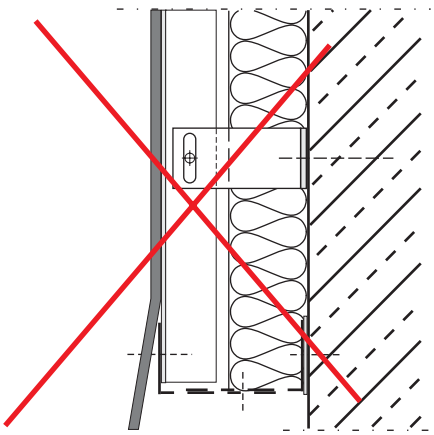
⌖ = sliding point, substructure

Avoiding of Tensions

Back-ups which cause tensions should be avoided by constructive measures. If underlaying materials ≤0,8mm are unavoidable, the required distance to the edge should be measured only beginning from that point.



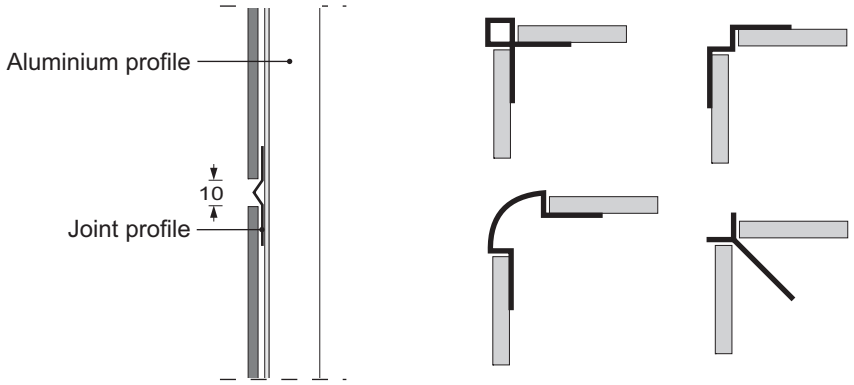




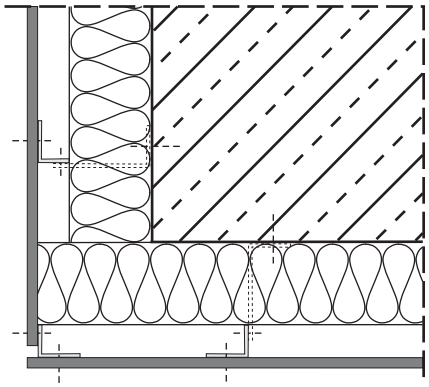
Backed Joints / Corner Profiles

For backed joints, joint profiles e.g. made of coated aluminium (d ≤0.8 mm) can be used. Overlapping of profiles is not permitted. The profiles must not cause any tensions. The expansion joints must be made without coupling. > p. 12

creaboard is able to color joint profiles in adaptation to the façade design. For further information, contact our service team. If horizontal joint profiles are used, more intensive and inconstant façade contamination is expected.



Reduced Wind Suction Loads



According to DIN 18516-1:1999-12, in buildings with ventilated curtain walls, no increased wind suction loads (older version: DIN 1055-4:1986) need to be considered in the edge areas, if the façade cladding is permeable to the wind, e.g. due to open joints between the façade panels. That means, that in the edges area there is no need of reinforced substructures and a higher number of fixing elements. The building edge area can be performed like the centre area. In this case, a durable and stable vertical wind barrier must be arranged along the vertical building edge of the entire building height, to effect necessary flow resistance in the ventilated space.

ill.: Example of a vertical wind barrier

Example of reduced Wind Suction Loads Calculation acc. to DIN 18516-1

Valid as following:
a) the relative air-permeability of the external wall cladding must be:

$$e = \frac{A_{joint}}{A_{wall}} \quad x\ 100\% \geq 0{,}75\%$$

b) The flow resistance must equal to the value in the equation: $F_w = s / a \leq 0.005$
s = depth of ventilated area
a = length of the quoin of the building

c) Along the vertical building edge, a durable and stable vertical wind barrier must be arranged across the entire building height, to effect necessary flow resistance in the ventilated area.

Only if conditions from a) to c) are fulfilled, the wind suction loads can be considered as reduced.

Example:
Relative air-permeability of the external wall cladding, if supposed that:

panel size: 3100 mm x 1250 mm
joint width: 8 mm
Flow resistance:
$F_w = s / a \leq 0.005 \qquad a \geq s / 0.005$

The ventilation area depth must be minimum 20 mm. The condition is fulfilled, if the length of quoin is
$a \geq (20\ mm / 0.005) = 4000\ mm = 4.00\ m.$

If the ventilation area depth is e.g. 80mm, the condition is fulfilled, if a quoin length
$a \geq (80\ mm / 0.005) = 16000mm = 16.00m.$
An effective wind barrier along the vertical building edge is to be arranged constructively.

$$e = \frac{8mm \times (3108mm+1258mm)}{3108mm \times 1258mm} \times 100\% =$$

0.893% ≥0.75% !

Thereby, the requirements for applying the centre-area wind-suction loads in the edge area of the buildings are fulfilled.

Maximal Panel Sizes for reduced Wind Suction Loads on Aluminium Substructures

At aluminium substructures, the vertical joint is usually closed, so the share of the horizontal open joints must be disproportionally large to approach reduced wind suction loads.

The use of reduced wind suction loads acc. to DIN 18516-1 is possible in following sizes of panels on vertical aluminium substructures, depending on the joint width.

Thus, costs of the substructure in the edge area that are usually higher, can be reduced to the ones of the normal area.

Overview of maximal panel heights for reduced wind suction loads

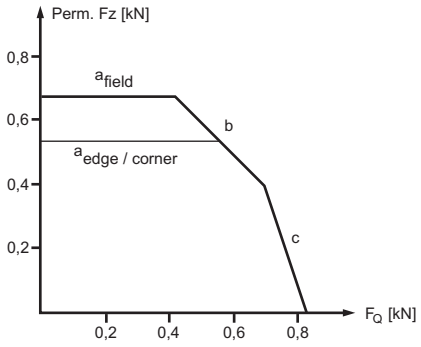
joint width	minimal panel width	3100	2800	1300	600	400	300	200
8mm	maximal panel height	960	955	925	855	770	675	490
joint width	minimal panel width	3100	2800	1300	600	400	300	200
10mm	maximal panel height	1200	1180	1160	1000	965	850	624
joint width	minimal panel width	3100	2800	1300	600	400	300	200
12mm	maximal panel height	1450*	1440*	1390*	1300*	1150	1020	750
Horizontal joint closing by vertical carrier profile		260	260	160	110	110	110	110

Values are applicable for open horizontal and closed vertical joints on aluminium substructures, all sizes are in mm, * value larger than the delivered size

The values for panel fixing, given in the tables below, are a non-binding help for calculating maximal net-sizes of panel dimensions. A static stability proof and a final planning based on it must always be performed in accordance with the current building project. Fastener distances depend on the current substructure, as well as on their positions and anchoring. The distances to edges must not be lower than the minimal ones given here. > p. 11

Stresses on Rivets

If creaboard façade rivets are stressed by diagonal pulling forces, the limit of the permissible pulling force (perm. F_z) must be set lower depending on the existing transverse force (F_Q), as shown in the diagram .
Depending on the position of the rivet on the panel, following lines are applicable:
a_{field} , or $a_{edge/corner}$

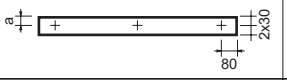
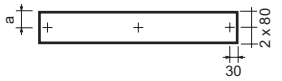
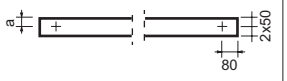
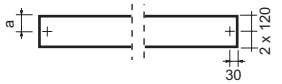
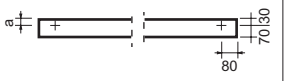
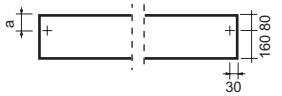
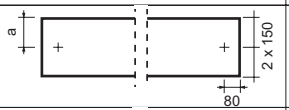
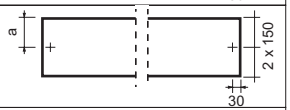
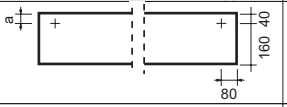
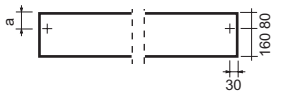
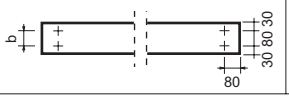
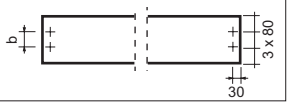


F_Q = available transverse force
$_{per.}F_Z$ = permissible pulling force

if $F_Q \leq 0{,}44$; $_{per.}F_Z = 0.67$ [kN] (a_{field})
if $F_Q \leq 0{,}5$; $_{per.}F_Z = 0.56$ [kN] ($a_{edge/corner}$)

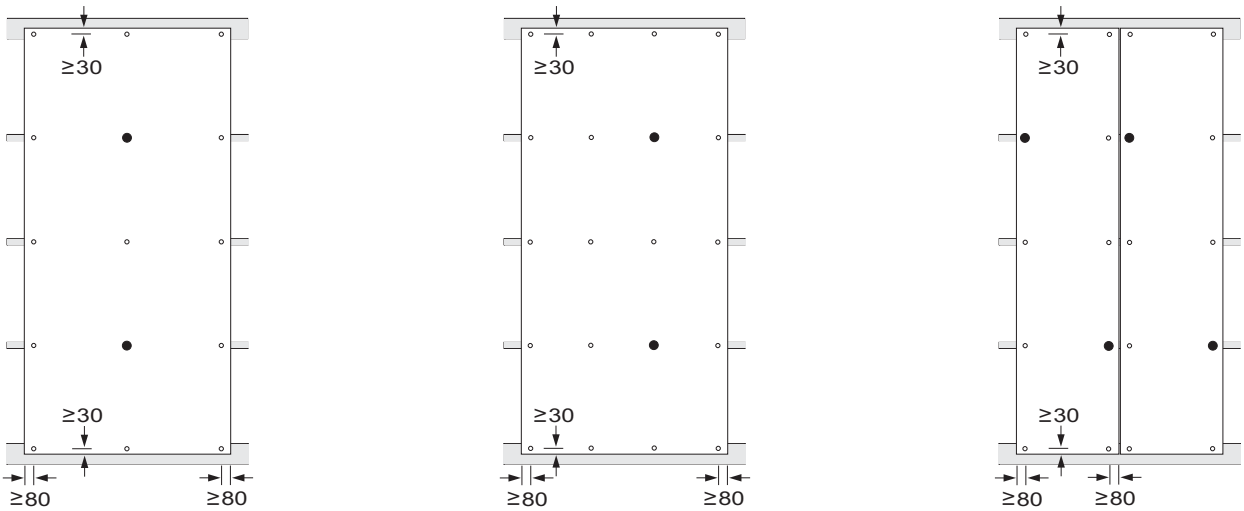
(b)
if $0.44 < F_Q \leq 0.69$;
$_{per.}F_Z = -1{,}113\ F_Q + 1{,}162$ [kN]
(c)
if $0.69 < F_Q \leq 0.82$;
$_{per.}F_Z = -3.045\ F_Q + 2.491$ [kN]

Fixing of narrow strips (8mm panel thickness) on an Aluminium Substructure

	carrier profile, horizontal		carrier profile, vertical	
narrowest size, up to max. 1.0m length, 1 fixing row	width from 60mm a = 30mm		width from 160mm a = 80mm	
narrowest size, up to max. 3.1m length, 1 fixing row	width from 100mm centrical fixing a = 50mm		width from 240mm centrical fixing a = 120mm	
	off-center fixing 30mm ≤ a ≤ 70mm		off-center fixing 80mm ≤ a ≤ 160mm	
widest size, up to max. 3.1m length, 1 fixing row	width bis 300mm centrical fixing a = 150mm		width bis 300mm centrical fixing a = 150mm	
	off-center fixing 40mm ≤ a ≤ 160mm		off-center fixing 80mm ≤ a ≤ 160mm	
narrowest size, up to max. 1.0m length, 2 fixing rows	width from 140mm b ≥ 80mm		width from 240mm b ≥ 80mm	

Number of fixing elements per each fixing row depends on the strip length and the building height.

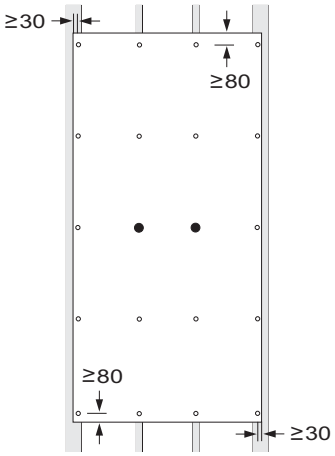
Fixing Layout - Horizontal Carrier Profiles

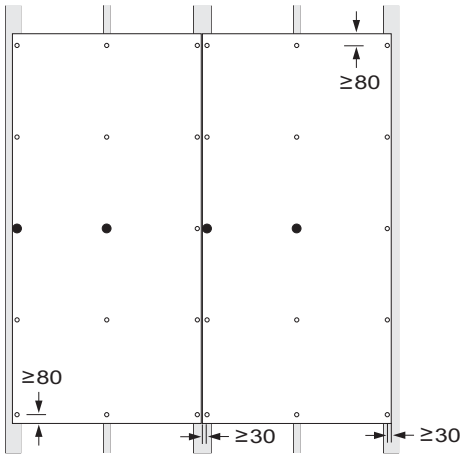


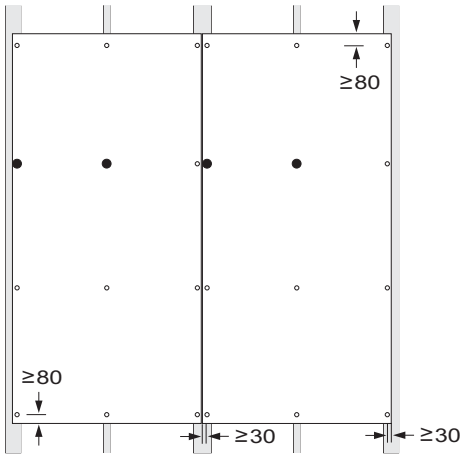
● fixed point with fixed point sleeve
○ sliding point

All sizes are given in mm

Fixing Patterns: Vertical Carrier Profile



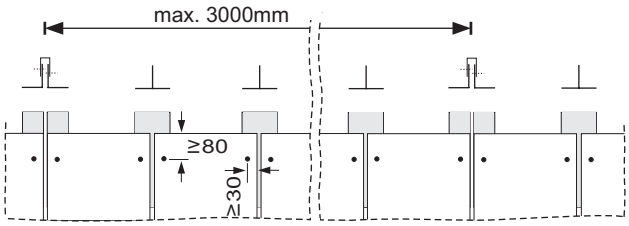




• fixed point mit fixed point sleeve
○ sliding point

Fixed points on panels arranged side-by-side must remain in the same position, i.e. always in the middle and on the left. So it is ensured that no coupling can occur between the panels.

If the panel is fixed as a one-field carrier, the aluminium substructure must be separated (interrupted) every 3.0 m in the horizontal direction at least. See the sketch on the right.



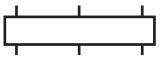
All sizes are given in mm

Fixing Distances and Wind Loads

Fixing the façade panels on aluminium substructures cannot be universally defined in tables, because it is directly governed by DIN 1055-4:2005-03 “Influence on Load-Bearing Structures, Part 4: Wind Loads“.
For calculation of wind loads on a ventilated curtain wall, following characteristics must be observed acc. to DIN 1055-4: 2005-03:
- building shape (variously)
- building height (correlation between the height and the width and length)
- regional wind zone (WZ) from I. to IV.
- ground category, from I. „flat ground without obstacles“ to IV.„town area“
- ground form „cliff or hilltop“
- height above the seal level (< 800 m, ≥800 m or ≥1.100 m above the main sea zero level)

Basically, it need not be reckoned with a higher number of fixing elements due to new values, because 93 % of wind zones found in Germany (I and II) only another allocation across the building shape can be expected. Needs on substructures will thereby remain the same. Thus only individually calculated fixing distances can be defined. For a construction project, an individual static stability proof must always be done. Following tables, based on old regulations, can be used as clues for determination of distances between fixing elements (however, without guarantee of correctness).
Respect valid national regulations.

Old regulations for fixing distances acc. to DIN 1055-4 (1986) on Aluminium Substructures
Panels are oriented horizontally, on vertical carrier profiles



Panel sizes height x width x thickness (mm)	Fixing distances (mm)	Building height Normal area			Building height Edge area*		
		< 8 m	8 < 20 m	20 - 100 m	< 8 m	8 < 20 m	20 - 100 m
1250 x 2500 x 8	horizontal a =	4 x 610	4 x 610	4 x 610	4 x 610	4 x 610	5 x 488
	vertical b =	2 x 545	2 x 545	2 x 545	2 x 545	2 x 545	3 x 363
1250 x 2800 x 8	horizontal a =	4 x 685	4 x 685	4 x 685	4 x 685	4 x 685	5 x 548
	vertical b =	2 x 545	2 x 545	2 x 545	2 x 545	4 x 272	4 x 272
1250 x 3100 x 8	horizontal a =	4 x 760	4 x 760	5 x 608	4 x 760	5 x 608	6 x 507
	vertical b =	2 x 545	2 x 545	2 x 545	2 x 545	3 x 363	3 x363

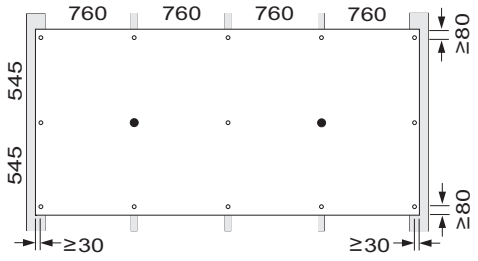
Minimum distances to the edges, horizontal: 30mm / vertical: 80mm, see page 11
Maximal fixing distance, constrcutively: at 8mm: a and b ≤800 mm / at 12mm: a and b ≤1020mm

*: Values for the edge area can be omitted, if wind suction loads can be estimated as reduced acc. to DIN 18516-1, see page 13

Application Example according to old DIN 1055-4 (1986)

Parameters:

- building height ≤ 8 m
- panel orientation, horizontal on vertical carrier profiles
- normal area of the building
- panel thickness 8mm
- panel size 1250 x 3100mm (H x W)



Values form the table (framed):

a = 4 x 760 mm
= horizontal fixing distance

b = 2 x 545 mm
= vertical fixing distance

General

Important components of external wall cladding on timber substructures are following:

- insulation, insulation holders
- anchoring elements
- connectors
- fixing elements
- counter battens / metal spacers
- carrier battens
- cladding material

For ancoring of the substructure in load-bearing walls, use combined dowels / anchors specially intended and permitted for this purpose.

For numbers, positions and dimensions, see the project- or final documentation.

For substructures to which panels are fixed, wood types of grade S10 or MS10 must be used acc. to DIN 4074-1.

Wood Preservation

Wooden substructures must be protected by preservation acc. to DIN 68800-2. Under conditions defined in DIN 68800-2, carrier battens and counter battens of risk class (GK) 0 do not need any preventive chemical treatment, neither against fungi nor against attacks by insects. Waiver of preventive chemical treatment of wood is a significant contribution to environmental protection.

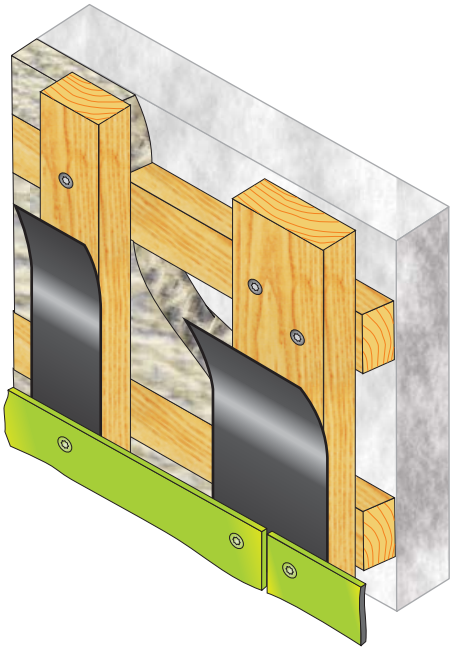
Carrier battens and counter battens fulfill requirements of risk class (GK) 0, if

- mounting moisture is $u_1 < 20\%$, or it is ensured that within a period of 6 months this moisture level is achieved due to desiccation.
- suitable measures are undertaken to ensure that when being used, the wood not become more humid than 20% for a long time.

That includes measures for protection against use-moisture (e.g. splashes of water), moisture from adjacent building components (drainage layers), and condensation water (proof acc. to DIN 4108-3). If the above mentioned requirements are not fulfilled, the substructure must be protected as defined in DIN 68800-3 „Chemical Preservation of Wood“.

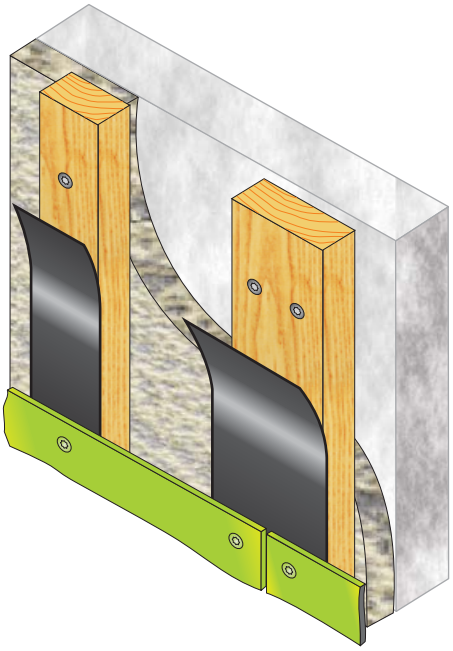
Substructure Variants

Standard construction



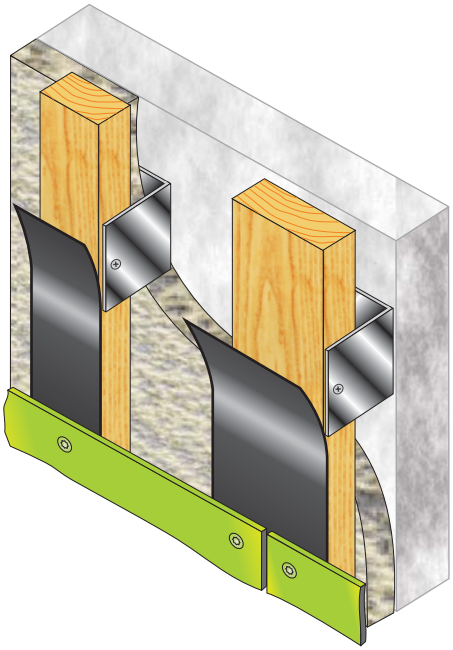
At this type, horizontal counter battens and vertical carrier battens are used. The insulation is placed between the horizontally arranged counter battens. The insulation is fixed here by insulation holders, whereas it can be also glued.

Carrier battens with frame dowels



Vertical carrier battens are placed on the insulation without spacers. The own load of the structure is carried by suitable frame dowels. The insulation is fixed by insulation holders in accordance with instructions of the manufacturer.

Substructure with spacers



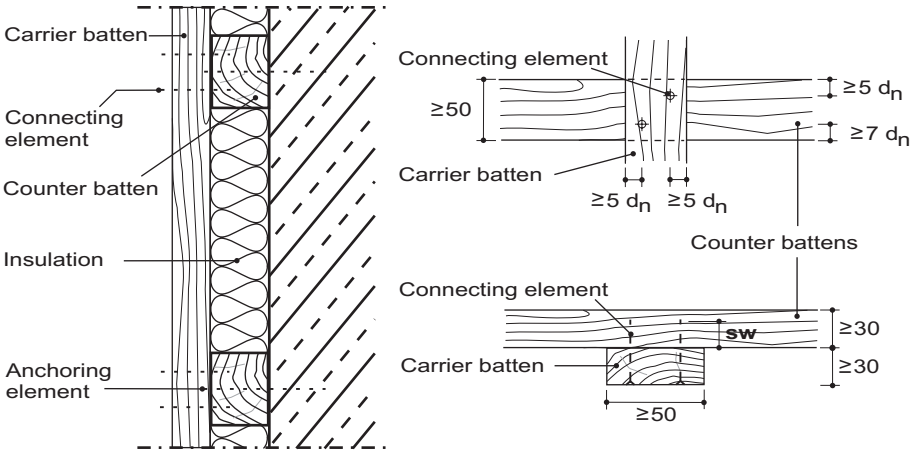
If the insulation is larger, the vertical carrier battens can be fixed on metal L- or U-spacers with thermal separation element. The corrosion resistance of the spacers against the used wood preservatives must be ensured.

Connection of Counter Battens and Carrier Battens

Minimum dimensions of battens and related screw and nail arrangements:

Arrangement:
Diagonal, 2 connecting elements per each battens cross-point. The carrier batten is usually oriented vertically.

Battens width refer only to the shown distances of the connecting elements. Depending on the type and arrangement of dowels (anchoring in the external wall), as well as on the arrangement of carrier battens behind a panel joint, the required width of battens may be correspondingly larger.



Connecting Elements

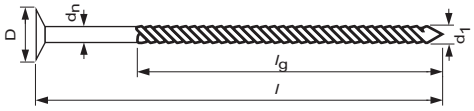
For mechanic fixing of carrier battens and counter battens, suitable connecting elements must be used acc. to DIN1052-2, e.g. special nails (with profiled shanks).

Nails with smooth shanks are not permitted for this area of application. For the type, quantity and position, see project and final documentation.

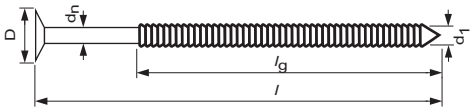
If special screws and clamps are used, a proof of suitability or approval for such fastening means is required.

Special nails

(Shown as an example)



Threaded nail



Grooved nail

Special nails are classified in load-bearing capacity classes I, II, and III according to their holding power in coniferous wood (resistance against stressing in shank direction, i.e. pulling out).

The permissible stress by pulling out (N_z) is determined as follows:

perm. $N_z = B_z \cdot d_n \cdot s_w$ in N

d_n is the nail diameter in mm, and
s_w is the effective drive-in depth in mm.

For special nails, the B_z values given in the table depend on the load bearing capacity class.

Load-bearing capacity class	Value B_z
I	1.8
II	2.5
III	3.2

Values B_z in MN/m² are applicable for calculation of permissible stress (perm. $N_{z,}$) of special nails.
The permissible nail stress (N1) is calculated for coniferous wood acc. to DIN 1052-1, table 1 (regardless of the quality class and fiber direction of wood) for a shear zone according to following equation:

$$\text{perm.}N_1 = \frac{500 \cdot d_n 2}{1000 + d_n} \text{ in N}$$

d_n is the nail diameter in mm.
At special nails, d_n is the diameter of smooth shank part or of the nail wire (nail nominal diameter) before the shank profiling. Following should be proved, when nails are under load on shearing and on pulling-out stresses at the same time:

$$\left(\frac{N_1}{\text{per.}N_1}\right)^m + \left(\frac{N_Z}{\text{per.}N_Z}\right)^m \leq 1$$

At round wire nails and machine pins, as well as special nails of load bearing capacity class I, it has to be calculated with m=1, and in special nails of load-bearing capacity classes II and III, it is calculated with m=2. If the special nails are driven into fresh wood, and humidity remains within the range of fiber saturation when it is in use, so the permissible stresses by pulling-out (perm.N_z) have to be reduced by 1/3.
That is not valid, if the wood is able to desiccate when being used and not applicable if deciduous wood belongs to wood of type group C.

Source:

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Fixing

For fixing of creaboard fibre cement panels, façade screws with colored heads are used. The panels must be mounted without tensions. Tension stresses because of deformations must not cause any damage of the cladding or substructure on connecting and fixing points. The tension-free mounting of panels on timber substructures is achieved, if all drilled holes of a panel are 2mm larger than the shank diameters of the fixing elements.

Façade Screws

To provide warranty, only following creaboard façade screws must be used:

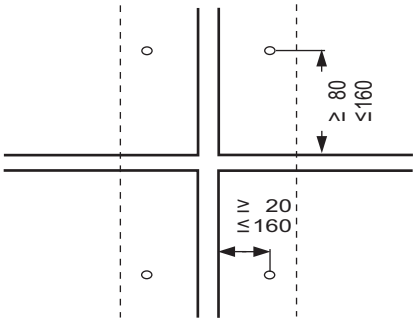
- 5.5 x 35 mm for 8 mm façade panels,
- 5.5 x 45 mm for 12 mm façade panels and weatherboarding (visible fixing) of 8 mm panels

Minimum drive-in depth is 25 mm

Material:
stainless steel, bit T 20

Screw heads should be of a color suitable for panel surface.

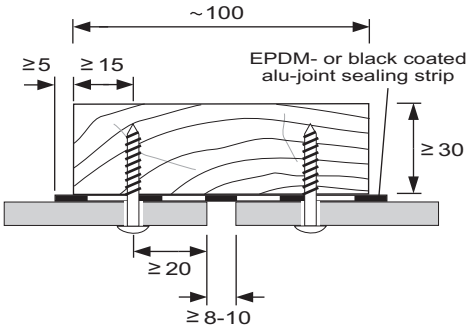
Minimum Edge Distances of Fixing Elements on Timber Substructures



The distances to edges must be minimum 80mm along wooden carrier battens and 20mm across the carrier battens. The edge distances should not exceed 160mm. In special cases, e.g. above shutter boxes, edge distances up to 200mm are permissible

If edge distances exceed 160mm, small differences between the levels of adjacent panels may result. That does not diminish the static stability. Batten sizes should be selected so that the distance from the screw to the batten edge is not smaller than 15mm. The hole must be drilled 2mm wider than the screw shank diameter.
For creaboard façade screws, Ø 6mm holes must be pre-drilled with a special drill for fibre cement in panels.

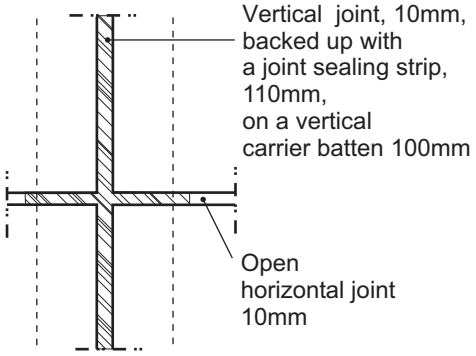
To avoid damaging the timber substructure by moisture, joint sealing strips must be placed between the panel and the carrier battens.



This constructional measure protects battens from lasting penetration of moisture. The strip of EPDM or black-coated aluminium foil must protrude minimum 5mm above the edge of the batten to be protected.

Joint Pattern

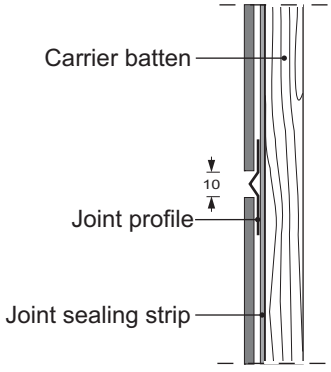
The optimal joint width in large-size façade panels is 10mm. This size ensures both an attractive joint pattern and technically proper functioning of the façade, as well. Joint width below 8 mm are not allowed. Open joints wider than 12mm are not permitted either.

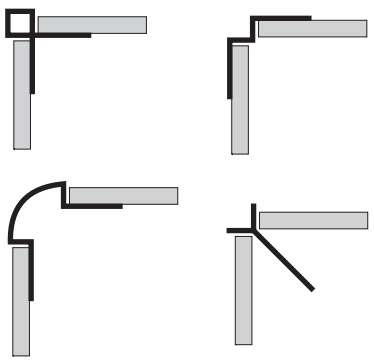


Compared with closed joints, open horizontal joints significantly reduce contamination of the facade surface. Additional ventilation cross sections resulting from that improve the functional safety of the curtain wall. According to practical experience, the façade function (rain protection) is ensured with open joints (8-10mm) as well.

Backed Joints / Corner Profiles

For backed joints, joint profiles e.g. made of coated aluminium (d ≤0.8mm) can be used. Overlapping of profiles is not permitted. The profiles must not cause any tensions. The expansion joints must be made without coupling. > p. 12
creaboard allows color adaptation of joint profiles to the façade design. For further informations, contact our service team. If horizontal joint profiles are used, a more intensive and inconstant façade contamination has to be expected.





The values for panel fastening, given in the tables below, are a non-binding help for calculating maximal net-sizes of panel dimensions. A static stability proof and a final planning based on it must always be performed in accordance with the current building project. Fastener distances depend on the current substructure, as well as on their positions and anchoring. The distances to edges must not be lower than the minimal ones given here. > p. 18

Fixing of narrow strips (8mm panel thickness) on Timber Substructures

	carrier battens, horizontal	carrier battens, vertical
narrowest size, up to max. 1.0m length, 1 fixing row	width from 60mm a = 30mm	width from 160mm a = 80mm
narrowest size, up to max. 3.1m length, 1 fixing row	width from 100mm centrical fixing a = 50mm	width from 240mm centrical fixing a = 120mm
	off-center fixing 20mm ≤ a ≤ 80mm	off-center fixing 80mm ≤ a ≤ 160mm
widest size, up to max. 3.1m length, 1 fixing row	width up to 300mm centrical fixing a = 150mm	width up to 300mm centrical fixing a = 150mm
	off-center fixing 40mm ≤ a ≤ 160mm	off-center fixing 80mm ≤ a ≤ 160mm
narrowest size, up to max. 1.0m length, 2 fixing rows	width from 120mm b ≥ 80mm	width from 240mm b ≥ 80mm

Number of fixing elements per fixing row depends on the strip length and the building height.

Fixing Distances and Wind Loads

Fixing the façade panels on timber substructures cannot be universally defined in tables, because it is directly governed by DIN 1055-4:2005-03 “Influence on Load-Bearing Structures, Part 4: Wind Loads“.
For calculation of wind loads on a ventilated curtain wall, following characteristics must be observed acc. to DIN 1055-4: 2005-03:
- building shape (variously)
- building height (correlation between the height and the width and length)
- regional wind zone (WZ) from I. to IV.
- ground category, from I. „flat ground without obstacles“ to IV.„town area“
- ground form „cliff or hilltop“
- height above the seal level (< 800 m, ≥800 m or ≥1.100 m above the main sea zero level)

Basically, it need not be reckoned with a higher number of fixing elements due to new values, because 93 % of wind zones found in Germany (I and II) only another allocation across the building shape can be expected. Needs on substructures will thereby remain the same. Thus only individually calculated fixing distances can be defined. For a construction project, an individual static stability proof must always be done. Following tables, based on old regulations, can be used as clues for determination of distances between fixing elements (however, without guarantee of correctness).
Respect valid national regulations.

Old regulations for fixing distances acc. to DIN 1055-4 (1986) on Timber Substructures
Panels are oriented horizontally on vertical carrier battens

Panel sizes height x width x thicknes (mm)	Fixing distances (mm)	Building height Normal range			Building height Edge area*		
		< 8 m	8 < 20 m	20 - 100 m	< 8 m	8 < 20 m	20 - 100 m
1250 x 2500 x 8	horizontal a =	4 x 615	4 x 615	4 x 615	4 x 615	4 x 615	5 x 492
	vertical b =	2 x 545	2 x 545	3 x 363	3 x 363	4 x 273	5 x 218
1250 x 2800 x 8	horizontal a =	4 x 690	4 x 690	4 x 690	4 x 690	4 x 690	5 x 552
	vertical b =	2 x 545	2 x 545	3 x 363	3 x 363	5 x 218	5 x 218
1250 x 3100 x 8	horizontal a =	4 x 765	4 x 765	5 x 612	4 x 765	5 x 612	6 x 510
	vertical b =	2 x 545	2 x 545	3 x 363	4 x 273	4 x 273	5 x 218

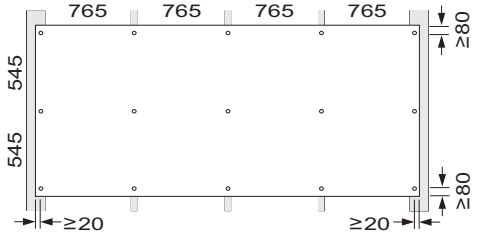
Minimum distances to edges, horizontal:20mm / vertical: 80mm, see page 18
Maximal fixing distance, constructively: at 8mm: a and b ≤800 mm / at 12mm: a and b ≤1020mm

*:Values for the edge area can be omitted, if wind suction loads can be estimated as reduced acc. to DIN 18516-1, see page 13

Application example according to old DIN 1055-4 (1986)

Parameters:

- building height ≤ 8 m
- panel orientation, horizontal on vertical carrier battens
- normal area of the building
- panel thickness 8mm
- panel size 1250 x 3100mm (H x W)



Values form the table (framed):

a = 4 x 765 mm
= horizontal fixing distance

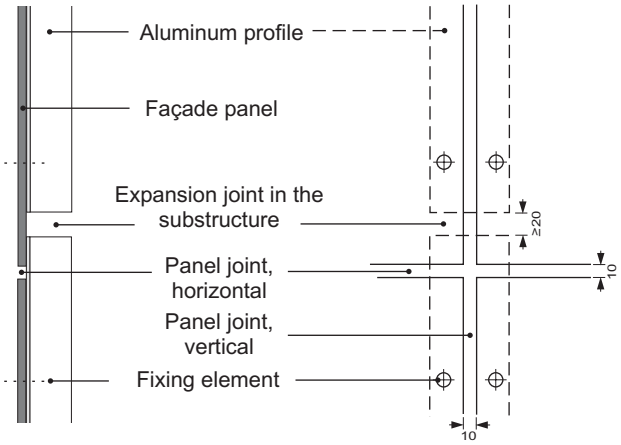
b = 2 x 545 mm
= vertical fixing distance

General

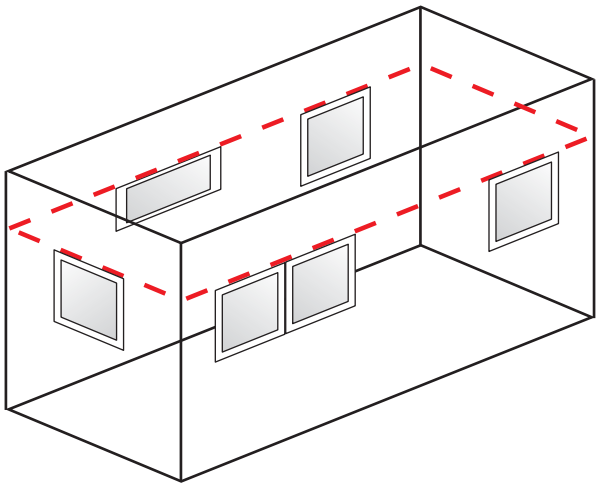
While planning a ventilated curtain wall on a building, some basic rules should be respected. Pay attention to an economic partitioning of the façade.

1. Joint Width

For large-size façade panels, the optimal joint width is 10mm. The joint width must not be below 8 mm. Open joints must not be wider than 12mm.
The joint width between the individual substructure profiles must be 20mm, at least.



2. The First Horizontal Joint

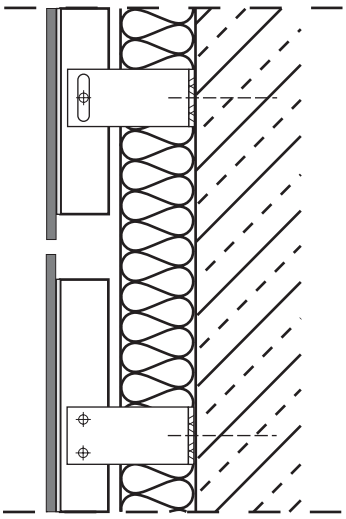


As far as possible, the first horizontal joint should run uninterruptedly around the building or building section at the height of window lintels or window sills.
So you create optimal conditions for mounting without tensions and avoid later damages by thermal expansion.

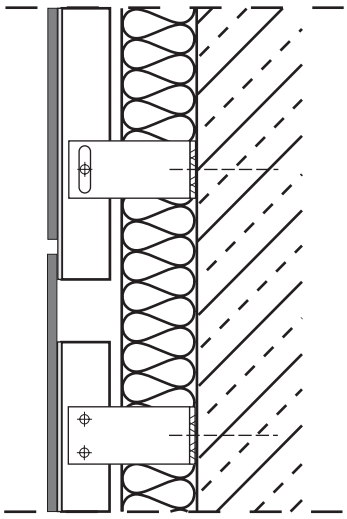
3. Horizontal Separation

Consider thermal expansion of the whole façade system. Due to this reason, ensure a horizontal expansion joint in the substructure and in the cladding at each storey height. Expansion joints should be considered for corner profiles, as well.

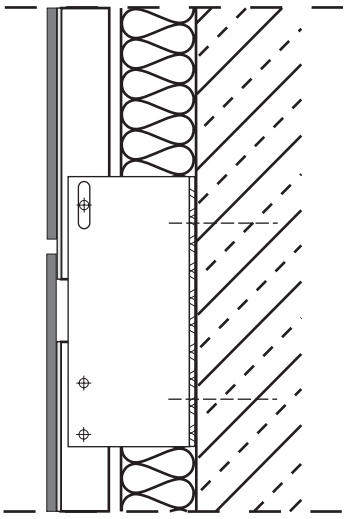
There are several possibilities to build a horizontal separation:



profile joint = panel joint



hidden profile joint,
panel joint is backed up

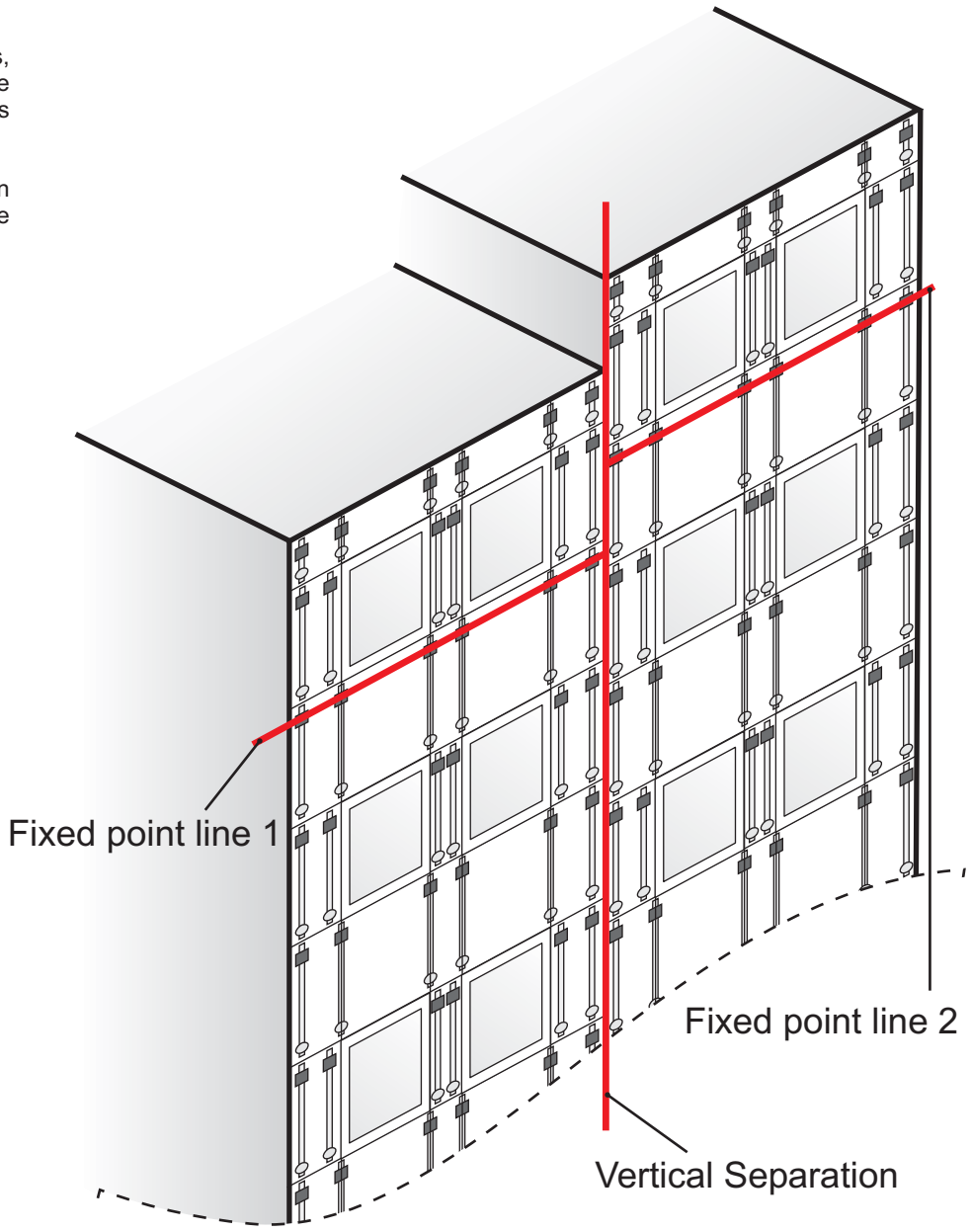


hidden profile joint,
panel joint is backed up,
combi-holder is used

4. Vertical Separation

Check whether on all substructure profiles, the fixed points can be arranged at the same level. If it is not possible, vertical separations in the substructure must be arranged.

As well, a panel can only be fixed on supporting profiles whose fixed points are situated at the same height.



5. Compensation of Tolerances on Window Reveals

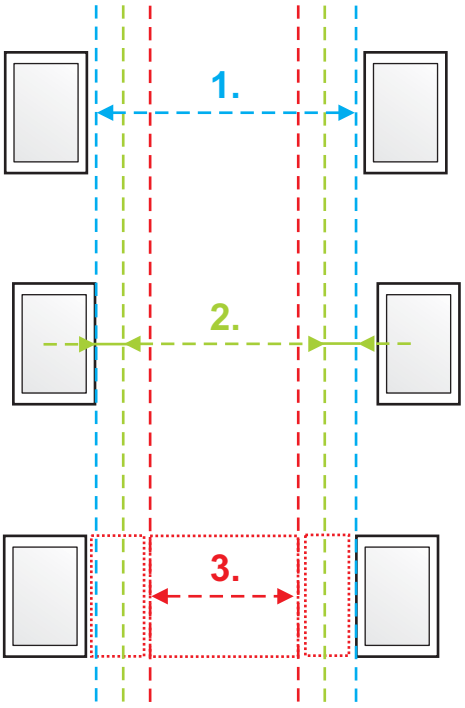
For tolerances in the vertical placement of ribbon windows arranged one above one (displaced window pattern), it is reasonable to use an both economically and esthetically attractive method.

In this way, the largest part can be prefabricated, so that only compensation panels between the middle panel and window reveal have to be cut to the individual size on site. Thus, an uninterrupted line of the vertical joint is achieved.

1.
Determine the smallest window distance.

2.
Provide at least 10cm one each side for a compensation strip.

3.
Optimize the resulting size for the middle panel according to static parameters (maximal supporting distance) and determine the new size for the middle panel.



Please note:

When performing a ventilated curtain wall, pay a special attention to such details as e.g. inner and outer corners, joints to windows and doors, and plinth transitions. Usual standard solutions from the practice are shown as sketches. In the sketches, the supporting profiles in aluminium-substructures are simply drawn as angle profiles or tees.

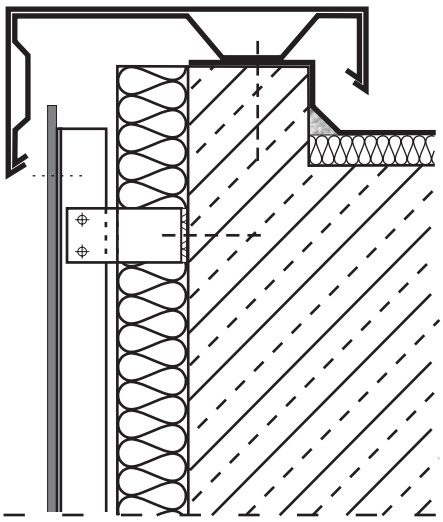
Accessories, e.g. joint profiles, perforated sheets etc. can be only used if their thickness are below or equaling 0.8 mm. Doubling of these profiles is not permitted. Profiles of a larger thickness can only be used if the façade panels are lying on the same level and can be fixed without tensions. Visible aluminium parts must be coated. Raw aluminium can unevenly discolor and cause disturbing contamination of cladding material.

For a long-term and safe functioning of the façade cladding, ventilation and deaeration openings of minimum 50 cm² cross-section per 1m wall length must be provided. For protection against small animals, the air openings must be closed with perforated profiles.

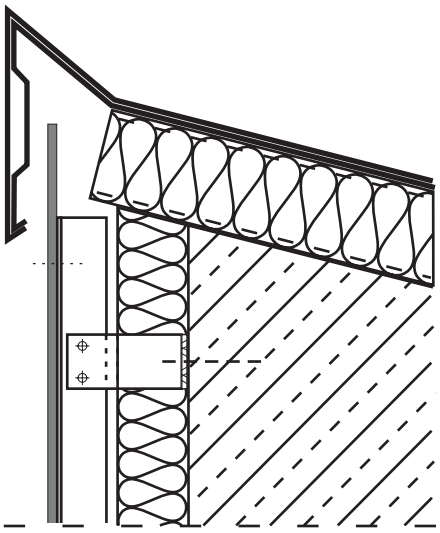
For wood protection against continuous moisture penetration, a sealing EPDM strip or a black-coated aluminum foil must be placed between the panels and carrier battens.

The ventilation profiles should be fixed on the external wall to avoid tensions in cladding material. If such a profile needs to be fixed on carrier battens or profiles for constructional reasons, its thickness must be below 0.8 mm. If its thickness is more than 0.8 mm, the profile must be mounted so that it does not cause any tensions. See the sketches.

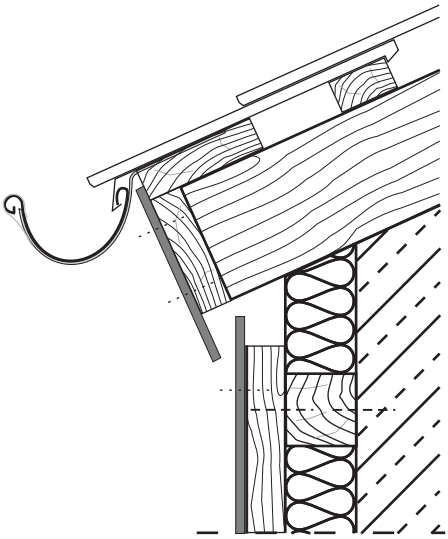
Attic / Eaves



Aluminium Substructure
Capping with coated metal sheets
Minimum distance from the drip edge to the cladding under it ≥ 20mm,
if copper is used ≥ 50mm

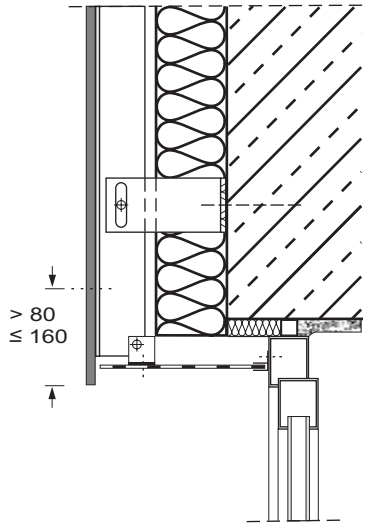


Covering of attica sheet / façade should be considered depending on the building height:
- up to 8m: min. 50mm
- from 8 >20m min. 80mm
- more than 20m min. 100mm

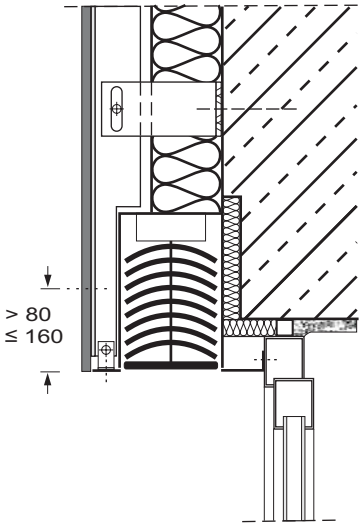


Timber Substructure
The fascia board can be clad with fibre cement strips. Ventilation gap is usually open.

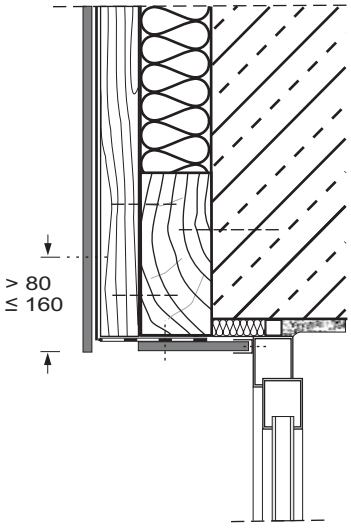
Lintel Cladding



Aluminium Substructure
Performed with a perforated profile for air inlet. Depending on the mounting depth of the window, a cladding material strip must be mounted, if necessary. The ventilation must be continuously ensured all the time!

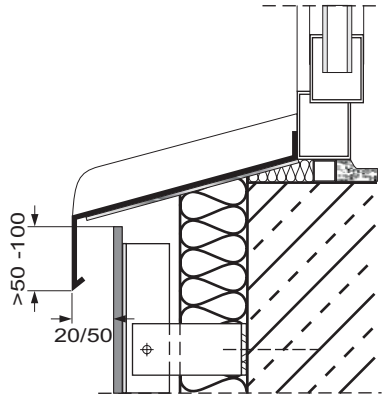


Aluminium Substructure
This variant is intended for integrated jalousie. If tapering of supporting profiles is required in this case, it must be agreed with the manufacturer of the supporting structure when calculating a static stability proof.



Timber Substructure
Facing with a strip of cladding material and a ventilation profile behind.

Window Sill



Performing usually with an angled window sill made of coated aluminium with lateral upturn. In this case, a gap of minimum 10mm between the cladding and the window sill is required. If the gap is larger, use suitable ventilation profiles. On surfaces with strong influence by rain, drip-profiles can be mounted additionally.

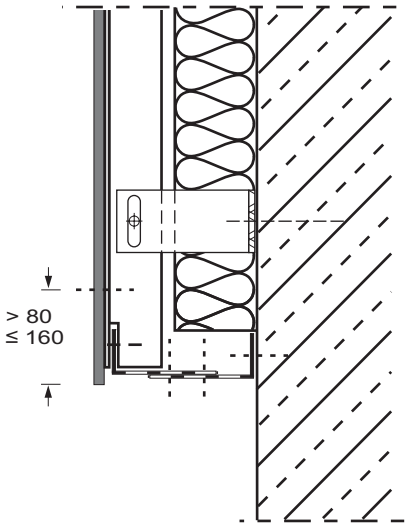
To reduce disturbing noise of rain drops knocking on this surfaces, it is recommended to mount sound-insulation material on the reverse side.

Minimum distance from the drip edge to the cladding under it is ≥ 20mm,
if copper is used ≥ 50mm

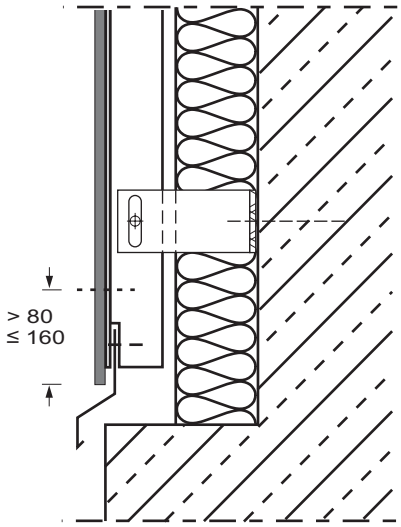
The window sill / façade covering should be considered according to the building height:

below 8m: min. 50mm;
from 8 - 20m min. 80mm;
more than 20m min. 100mm

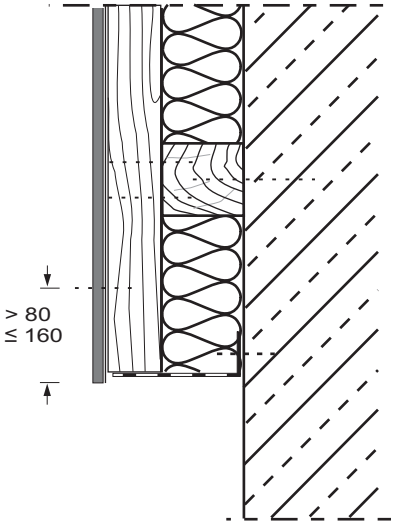
Plinth



Aluminium Substructure
Ventilation profile mounted behind the supporting profile and on the external wall

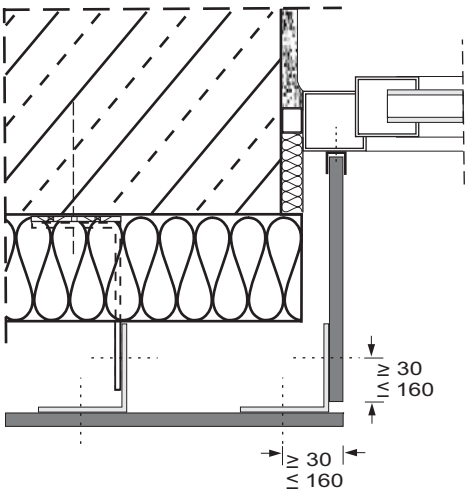


Aluminium Substructure
Coated plinth profile >0.8mm mounted behind the supporting profile

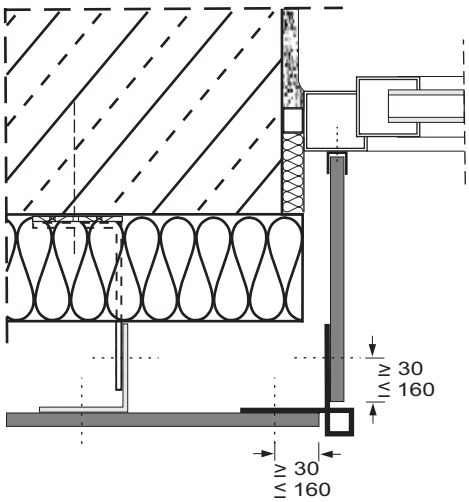


Timber Substructure
Ventilation profile mounted on the external wall

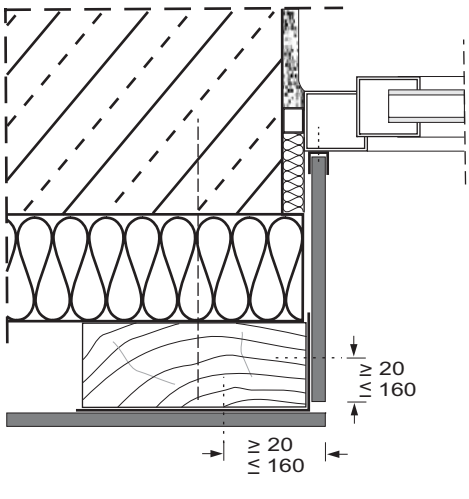
Window Reveal



Aluminium Substructure
The U-profile mounted on the window frame holds the reveal panel. The corner is performed with a hidden L-profile, and the façade panel covers the reveal strip.

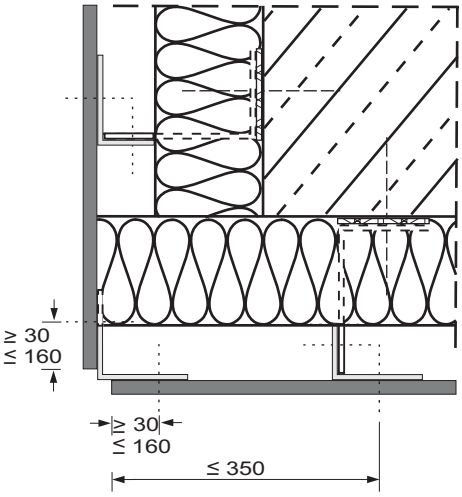


Aluminium Substructure
The U-profile mounted on the window frame holds the reveal panel. The corner is performed with a coated corner profile.

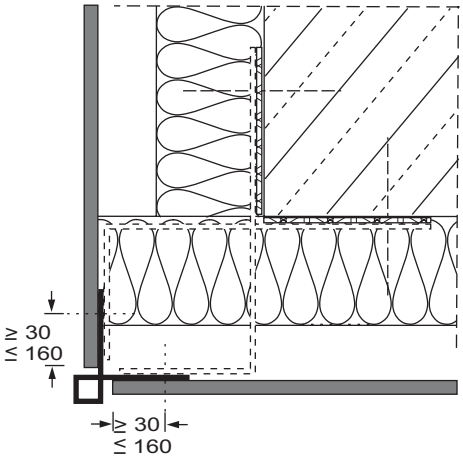


Timber Substructure
The U-profile mounted on the window frame holds the reveal panel. On the corner batten a joint sealing strip is attached and then the panels mounted on it, whereas the façade panel covers the reveal strip.

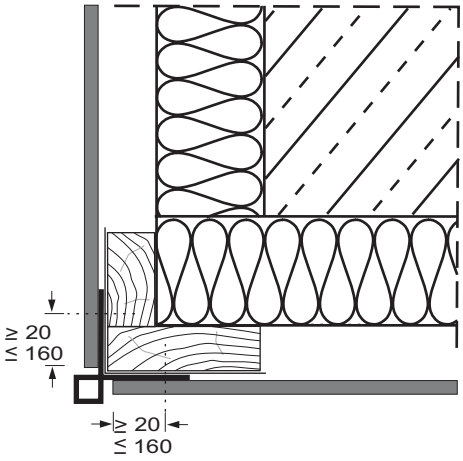
Outer Corners



Aluminium Substructure
Standard corner variant, the corner is backed with an aluminium L- profile, the insulation material forms a vertical wind barrier. > p. 13

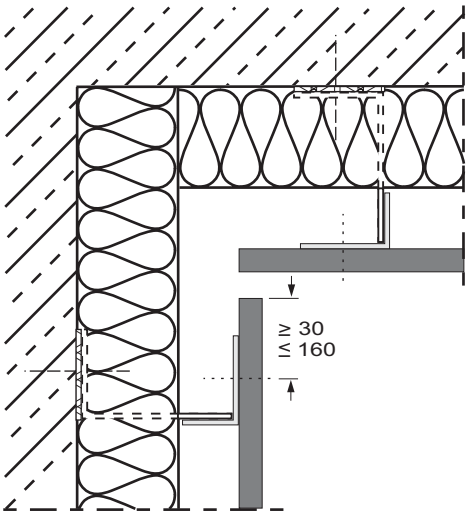


Aluminium Substructure
The outer corner is provided with a coated corner profile, the insulation material acts as a wind barrier. > p. 13

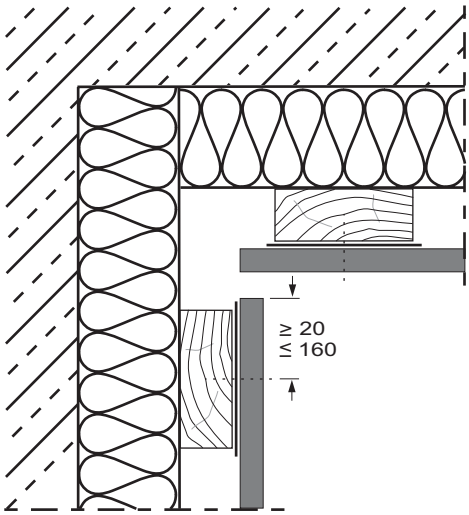


Timber Substructure
The outer corner is made with a vertical carrier batten, a joint sealing strip on it and a coated corner profile.

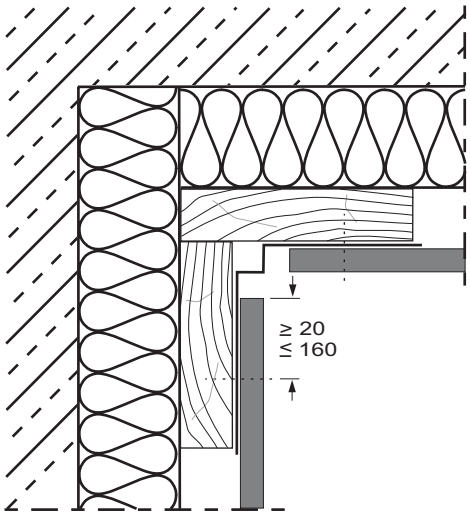
Inner Corners



Aluminium Substructure
Corner version with open vertical joint



Timber Substructure
Corner version with open vertical joint



Timber Substructure
Corner version backed with corner profiles

Designing

Weatherboarding creates a distinctive appearance and can be placed on timber or aluminium substructures in many variants. Depending on the fixing type and requirements on it, you can select panels of any size. See the tables below.

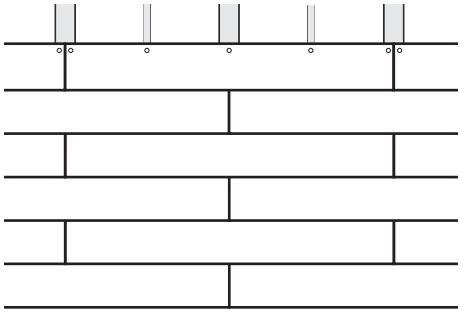
Following design factors are significant:

- creaboard design options (see Product Range)
- surface texture
- placing and joint pattern
- sizes
- type of fixing

The minimum joint width is 8 mm.

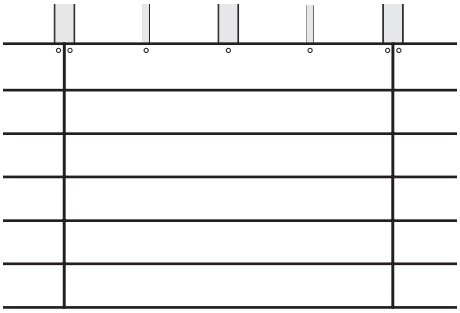
Example:

Displaced vertical joint, invisible fixing



Example:

Uninterrupted vertical joint, invisible fixing



Delivery Sizes / Cut to Size

Stripes of desired size are individually cut out from large façade panels (8 mm thickness, with punched edge). Holes are usually drilled on site. Cut edges must be protected against moisture. > p. 9

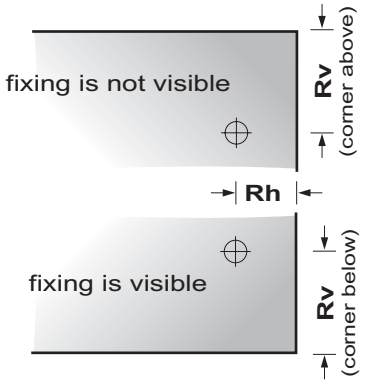
Cutting panels to the desired size and drilling holes can be made at the factory. Depending on design variant, it is also possible to coat the edges at the factory. Please contact our technical service team for more details.

	net size	produced size	thickness
optimal height	240, 300, 400, 600mm	1250 x 2500mm	8mm
maximal length	2500, 3100mm	1250 x 3100mm	

Minimum Distances from drill holes to edges

carrier profile or batten	substructure	horizontal edge distance (**Rh**)
vertical	aluminium	30 mm
	wood	20 mm
horizontal	aluminium	80 mm
	wood	

type of fixing	vertical edge distance (**Rv**)
invisible	50 mm from above
visible	45 mm from below



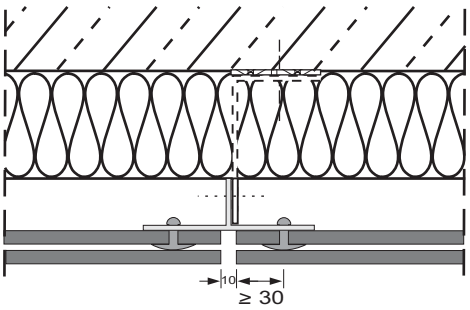
Mounting on Aluminium Substructures

Weatherboarding can be fixed on usual aluminium substructures. Carrier profiles can be placed vertically or horizontally. The vertical direction is more common. The mounting must be done without tensions.

For this purpose, Ø 9.5 mm holes are drilled with a special drill for fibre cement in the panels. The panels must be fixed without tensions by sliding points and two fixed points (use a fixed point sleeve). If there are cavities under panels, use a rivet jig.

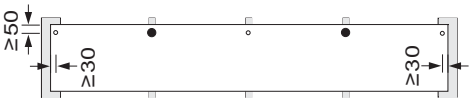
Joints of horizontal carrier profiles must not be situated between fixing points of one panel. Joints of vertical carrier profiles must be at the same height.

Joint Pattern

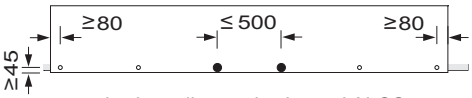


For esthetic reasons, the vertical joint can be backed with a joint strip. When mounting panels with displaced joint, insert two rivets in the middle of the panel. One rivet serves for fixing, and the other as a support for the panel lying above it. Keep the required minimum distances.

Fixed point with a fixed point sleeve ●
Sliding point ○



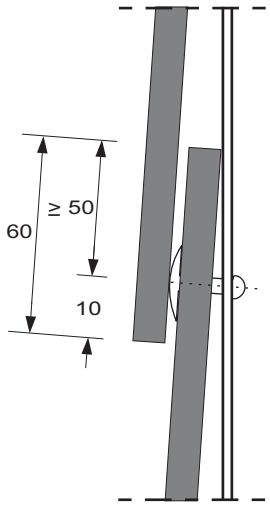
weatherboarding on vertical Al-SS



weatherboarding on horizontal Al-SS,
Please note: fixed points distance is ≤ 500mm

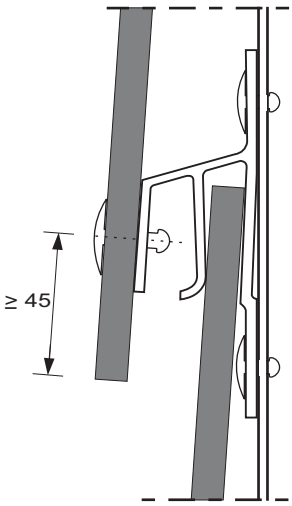
Fixing Variants

A



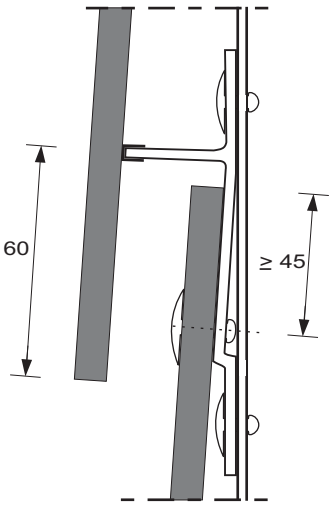
Invisible standard fixing on vertical carrier profile, panel is lying on.

B



Visible fixing by means of horizontal carrier profile, profile creates gap.
(BWM Dübel+Montagetechnik GmbH - horizontal clamping profile, item No..437300)

C



Visible fixing by means of horizontal carrier profile, profile creates gap.
(WS Fassadenelemente GmbH - bevel siding profile, WTP 300)

Fixing Distances on Aluminium Substructures (DIN 1055-4 /1986)

For a project, an individual static stability proof must always be done. For orientation of the distances between fixing elements you can take values from table below. However, we bear no responsibility for absolute correctness.

Panel thickness 8mm

fixing variant	maximal panel height	visible panel height up to	vertical overlapping	distances between fasteners and edges (vertical)		max. fasteners distances[1] (horizontal) for normal area building height		
				above	below	0 < 8m	8 < 20m	20 - 100m
A	240	180	≥ 60	50	-	800	750	660
A	300	240	≥ 60	50	-	800	720	590
B*	300	260	≥ 40	-	45	800	800	800
B*	400**	360	≥ 40	-	45	800	800	800
B*	600**	560	≥ 40	-	45	800	800	800
C*	240	180	≥ 60	50	-	800	800	800
C*	300	240	≥ 60	50	-	800	800	800

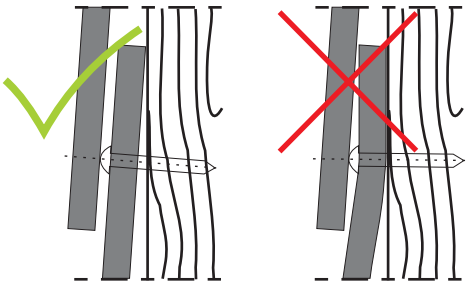
* Values are only applicable for uninterrupted horizontal profiles
** sizes are only possible if fixing/clamping below and above
All sizes are given in mm

Values for the edge area can be omitted, if wind suction loads can be estimated as reduced acc. to DIN 18516-1, see page 13
[1] at horizontal carrier profiles, the distance between fixed points is ≤ 500mm

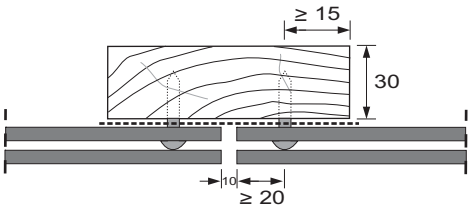
Mounting on Timber Substructures

Weatherboarding is mostly placed on vertical battens. They can also be mounted on horizontal battens, however, it requires more time and material. If necessary, thermal insulation can be placed between the horizontal counter-battens. The batten width should be minimum 50mm. Under the panel joints, this width must be 100mm.

To fix panels, creaboard façade screws are used. The drill holes for them must be 2mm larger than the screw shank diameter. The holes are to be drilled with a special drill of Ø 6 mm for fibre cement.
Align the screw at 90° to the panel and screw-in the so that the panel does not deform and cannot be damaged because of too much tension.



Joint Pattern



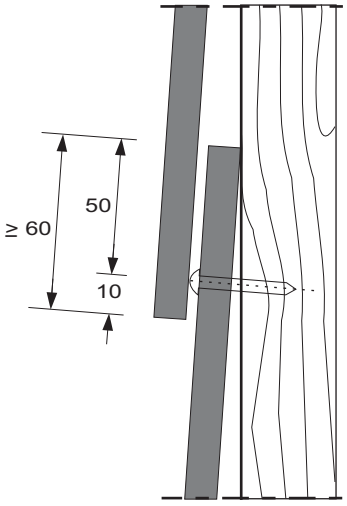
The joint width must be 8mm, at least. Battens under panel joints must be protected against moisture with an uninterrupted sealing strip. If panels are displaced, the intermediate battens must also be protected with a sealing strip.

Vertical joint, panel is lying on

When mounting panels with displaced joint, insert two screws in the middle of the panel. One screw serves for fixing, and the other as a support for the panel lying above it. Keep the required minimum distances.

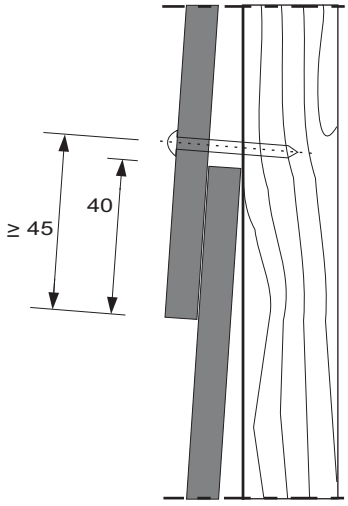
Fixing Variants

D



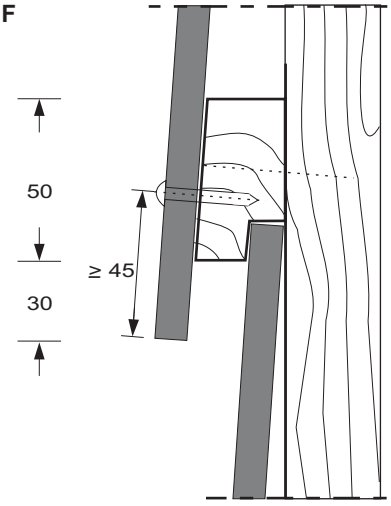
Invisible fixing, panel is lying on

E



Visible fixing, panel is lying on.

F



Visible fixing, panels with gap.

Fixings Distances on Timber Substructures (DIN 1055-4 /1986)

For a project, an individual static stability proof must always be done. For orientation of the distances between fixing elements you can take values from table below. However, we bear no responsibility for absolute correctness.

Panel thickness 8mm

fixing variant	maximal panel height	visible panel height up to	vertical overlapping	distances between fasteners and edges (vertical)		max. fasteners distances (horizontal) for normal area building height		
				above	below	0 < 8m	8 < 20m	20 - 100m[1]
D	240	180	≥ 60	50	-	800	730	640
D	300	240	≥ 60	50	-	800	570	410
E	300	260	≥ 40	-	45	800	800	680
E	400**	360	≥ 40	-	45	800	780	670
E	600**	560	≥ 40	-	45	600	490	420
F*	300	260	≥ 40	-	45	800	800	800
F*	400**	360	≥ 40	-	45	800	800	800
F*	600**	560	≥ 40	-	45	800	680	540

* Values are only applicable for uninterrupted horizontal profiles
** sizes are only possible if fixing/clamping is below and above
All sizes are in mm

Values for the edge area can be omitted, if wind suction loads can be estimated as reduced acc. to DIN 18516-1, see page 13
[1] respect the fire protection regulations

General

Balcony panels are mostly used for persons safety and must fulfill many guidelines and norms due to this reason. Fire protection and constructional safety are the most important requirements made on these structures.

creaboard balcony panels are coated on both sides and provide both individual design freedom and full safety. They are suitable for balustrade systems made of aluminium, steel or wood.

Features:

- high safety

- numerous design variants

- very large potential for creative design

- non-combustible (A2-s1,d0)

The balcony panels can also be used for partition walls, visual covers and wind protection components, fillings for gates, roof gardens and stairs balustrades.

creaboard balcony panels made of fibre cement are non-combustible construction materials suitable for buildings of any kind and height. Safety and quality are the most important criteria.

Instructions for Fixing

Standard mounting is done by aluminium blind rivets (colored), or by stainless steel safety screws. It is also possible to fix the panels by clamp holders or frame profiles. It is permitted to fix balustrade systems by rust-proof elements only. Fixing points are easy to prepare and provide a high mounting safety, because only sliding points are required.

Joint Pattern and Edge Protection

Temperature and air humidity changes can cause changes in length (+1.0/-0.5mm) of creaboard balcony panels. Joints to adjacent building components and between balcony panels should be minimum 10 mm, also for esthetic reasons.

To achieve an ideal overall appearance and the maximum life-cycle, it is recommended to use creaboard „Edge Sealant“. > p. 9
Depending on the selected design variant, edges can be coated at the factory, so that sealing on site is not necessary anymore.

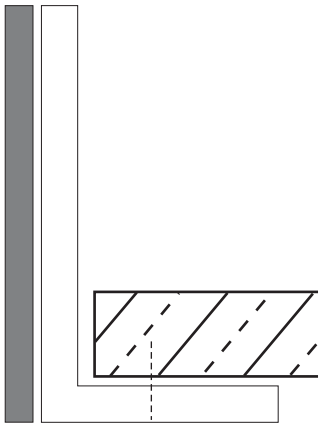
If the lower edge of the balcony panel is provided with an edge profile, it must be ensured, e.g. by suitable drainage openings, that no water can accrue in the profile.

Anchoring Variants

Balustrade loads must be transferred into the supporting structure via its fixing. For anchoring a balustrade, use only straddle-tension-free dowels and connection anchors, or undercut anchor bolts.

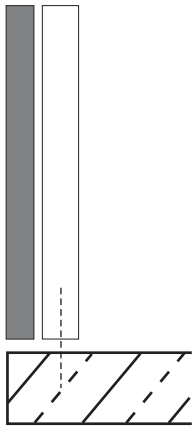
To dimensioning balustrades, a static calculation or type test must be available. Mounting of balustrade systems must be done only with rust-proof fasteners.

Only dowel systems can be used which are permitted for this purpose.



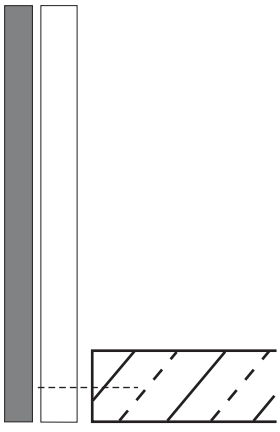
Underneath

This kind of anchoring helps to avoid penetration of moisture into fixing points. It inhibits damaging by corrosion and makes easier to keep the required distances to the edge. Withdrawal forces on fixing points can be kept relatively small. The front side of the balcony floor slab is hidden.



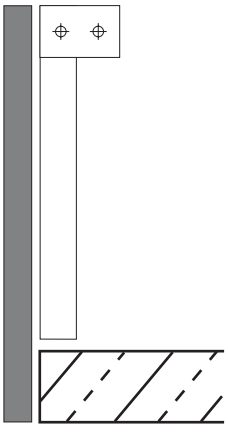
Above

If anchoring is done from above, it is necessary to thoroughly seal the anchoring point against penetration of moisture from above to avoid corrosion at the base point, as well as frost damage on the balcony floor slab. The front side of the balcony floor slab is not covered.



In front

Due to high withdrawal loads on the anchoring points, high requirements are made on this kind of anchoring. It requires large distances between the dowel and the edge. That is only possible in very thick balcony floor slabs. The front side of the balcony floor slab is hidden.



Laterally

The balustrade is anchored on both sides to the wall. Thus no stresses are transmitted into the balcony floor slab via the balustrade. The front side of the balcony floor slab can be hidden.

Wind Loads

The value of the wind pressure to affect on a surface unit of a construction material surface is $w = c_p \cdot q$

c_p: aerodynamic wind pressure coefficient; it consists of wind pressure and wind suction factors at open building bodies. For all building points, following is usually applied:

$c_p = 0.8 + 0.5 = 1.3$
q: back pressure of the wind

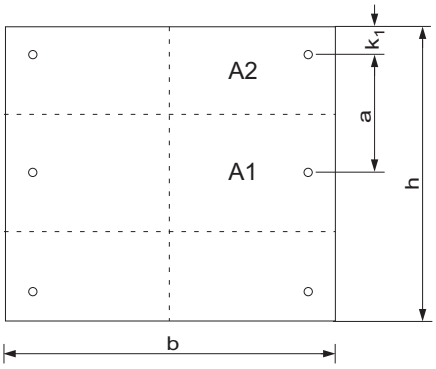
Wind loads depending on building height

height above the ground	back pressure q (kN/m²)	c_p coefficient	wind load w (kN/m²)
< 8 m	0.5	1.3	0.65
> 8 - 20 m	0.8	1.3	1.04
> 20 - 100 m	1.1	1.3	1.43

Quantity and Distances of Fixing Elements

Usually, the middle surface (A1) is decisive for measuring of distances between fasteners (a). In the case of high stresses and large edge distances (k1 or k2), smaller fastener distances can result on panel edges (measuring according surfaces A1 or A2) because the permissible stresses on the fixing points in edge areas are lower.

The maximal distances between fasteners can be determined by $F_z = w \cdot A$.



One-field panel:

$A1 = a \cdot 0.5\ b$
$A2 = (0.5a + k_1) \cdot 0.5\ b$

Example: one-field panel:

$A1 = a \cdot 0.5\ b$
$Fz = w \cdot a \cdot 0.5\ b$

$$a = \frac{Fz}{w \cdot 0.5b}$$

For panel width of 1m and building height of 10m, following is determined:

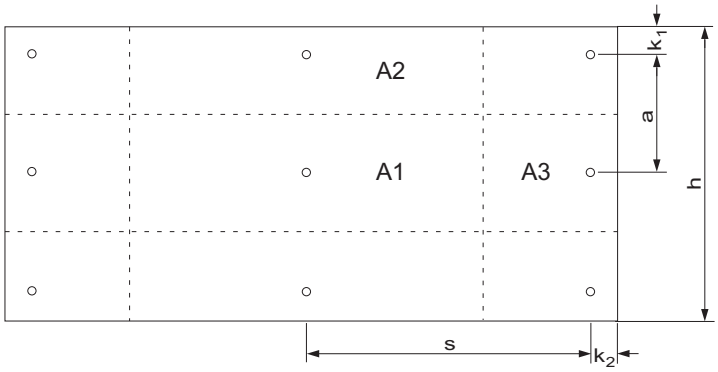
$$a = \frac{0.29\ kN}{1.04\ kN/m^2 \cdot 0.5 \cdot 1m} = 0.55m$$

Following conditions must be fulfilled:

Permissible $F_Q > G$;
Permissible $F_z > w \cdot A$;

$$\frac{G}{\text{perm. } F_Q} + \frac{w \cdot A}{\text{perm. } F_z} \leq 1$$

F_Q: permissible shearing stress of the fastener
F_Z: permissible tensile load of the fastener
A: effective panel surface per fastener
G: share of the own load from the balcony panel per each fastener



Two-field panel:

$A1 = 1.25s \cdot a$
$A2 = 1.25s \cdot (0.5a + k_1)$
$A3 = (0.375s + k_2) \cdot a$

Permissible stresses with balcony panels

	balcony screw / balcony rivet, Fs_{min} = 1.8mm	
	edge (Ra_{min} = 30mm)	middle
F_Q (kN)	0.37	0.53
F_Z (kN)	0.29	0.51

Ra_{min} = minimum edge distance of drill holes
Fs_{min} = minimum flange thickness of the aluminium substructure

Fixing by Rivets or Screws

Standard fixing is made by means of colored aluminium rivets, or rust-proof safety screws. The expected changes in length of creaboard balcony panels are small, so there is no need of distinguishing between fixed or sliding points of fastening = the mounting safety is high.

Drill holes:

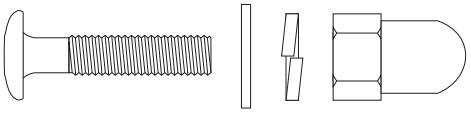
- in the substructure: 5.1 mm
- in the balcony panel:
  - for balcony rivets 7.0 mm
  - for balcony screws 7.0 mm

Balcony rivet

Material: aluminium / stainless steel, color coated head

Rivet shank Ø:	5 mm
Rivet head Ø:	11 mm
Rivet shank length:	18 mm (clamping range is 12-14 mm)

Balcony screw with cap nut

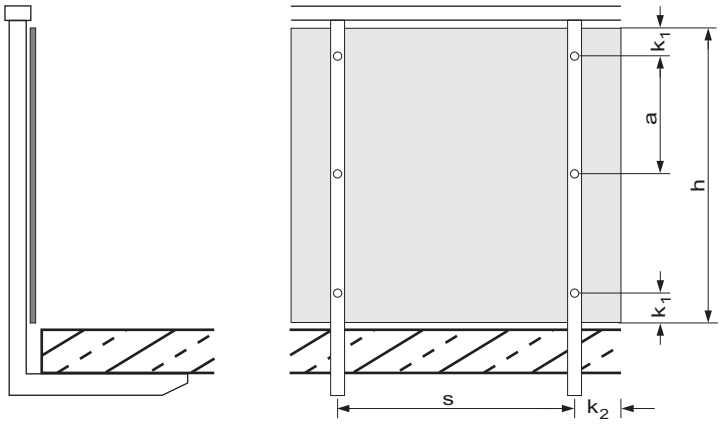


Material: stainless steel, color coated head

Thread Ø:	5 mm
Screw head Ø:	16 mm
Torque:	2-4 Nm

If the holes are drilled in steel substructures afterwards, observe corrosion protection!

Mounting on Railing Posts



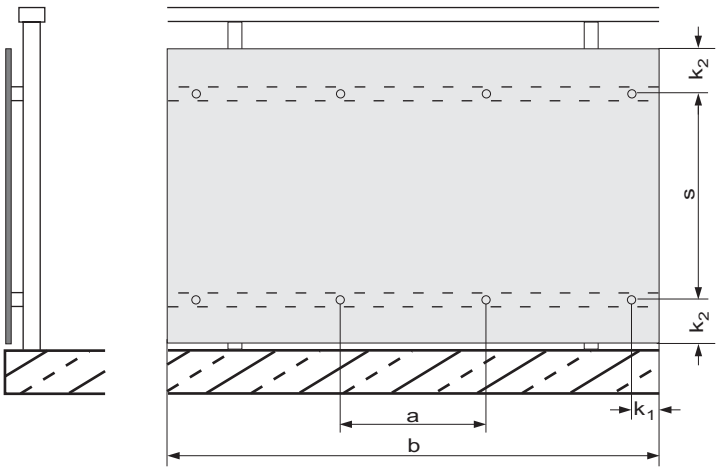
Panel height:
h ≥ 1000mm

Edge distances::
k_1 = 80 - 160 mm
k_2 = 30 - 160 mm

Span widths and distances between fasteners

building height m	max. **a** mm	max. **s** mm
0 - 20	400	800
>20 -100	400	750

Mounting on Horizontal Balustrade Profiles



Panel width:
b ≥ 1000mm

Edge distances:
k_1 = 80 - 160 mm
k_2 = 30 - 160 mm

Span widths and distances between fasteners

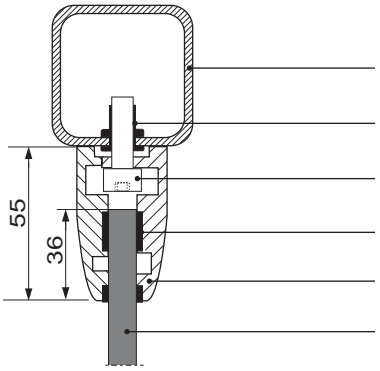
building height m	max. **a** mm	max. **s** mm
0 - 20	400	800
>20 -100	400	750

Fixing by Clamp-Holders

At this variant, a balcony panel is fixed on posts, or cross-beams of the balustrade structure by means of minimum 6 clamp-holders. If vertical clamp-holders are used, each balcony panel must be secured against sliding down by two safety bolts.

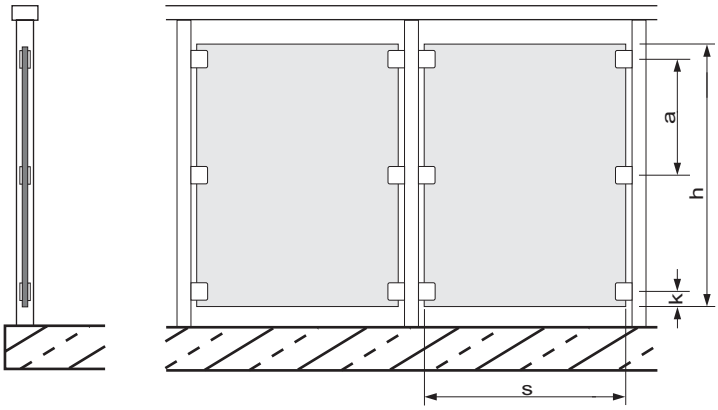
If movement differences between the balcony panel and the substructure are expected to be larger than 1mm (e.g. in aluminium substructures and uninterrupted balcony panels of lengths more than 2m) it must be constructively considered, e.g. by fixing of clamp-holders in oblong holes. Until a panel length < 2 m, length variations of panels can be compensated by using rubber profiles in the clamp-holders.

The clamp-holder can be fixed on the balustrade profiles e.g. by means of rivet nuts (M8), or through suitable threaded holes in the balustrade profiles. When balcony panels are fixed by clamp-holders, 2-3 mm clearance to the ground of clamp is required (clamping depth is 35 - 36 mm)



Ill.: Clamp-holder of type 4805, Pauli+Sohn

Mounting on Balustrade Profiles



Panel height:
h ≥ 860mm

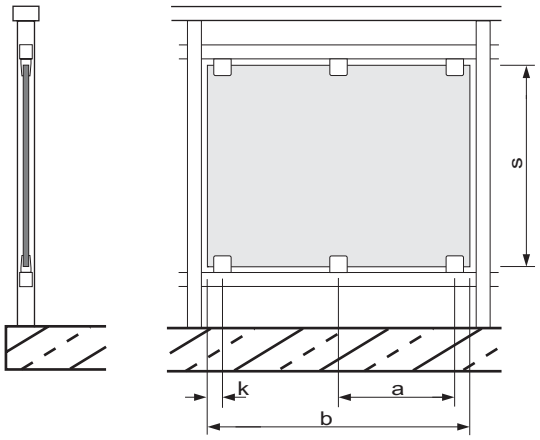
Protrude width:
k < 200 mm

Span widths and distances between fasteners

building height m	max. **a** mm	max. **s** mm
0 - 100	400	700

Each panel must be secured with a safety bolt against sliding down on the right and left.

Montage an Horizontal Balustrade Profiles



Panel width:
b ≥ 860mm

Protrude width:
k < 200 mm

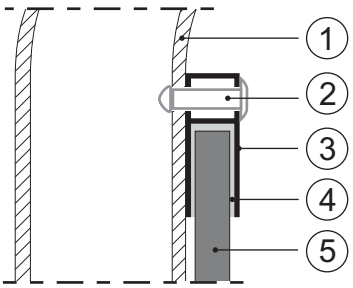
Span widths and distances between fasteners

building height m	max. **a** mm	max. **s** mm
0 - 100	400	700

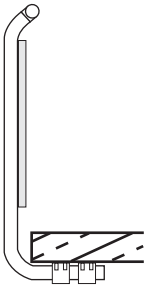
Fixing by Frame Profiles

creaboard balcony panels can also be fixed by means of frame profiles or edge profiles. Tensions in the structure must be avoided, therefore, 1mm/m movement tolerance must be ensured, especially in the longitudinal direction. The balcony panels can be inserted into the edge profiles with EPDM rubber profiles. The groove depth should be minimum 25 mm.

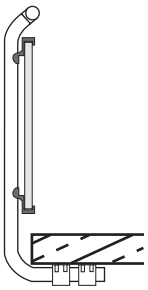
If the lower edge of the balcony panel is provided with an edge profile, it must be ensured, e.g. by suitable drainage openings, that no water can accrue in the profile.



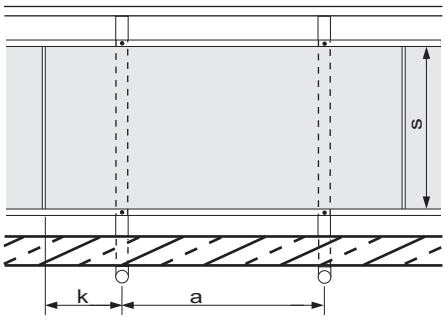
1 Railing post
2 Blind rivet
3 Frame profile
4 EPDM profile
5 Balcony panel



direct fixing



fixing with a spacer



k ≤ 400

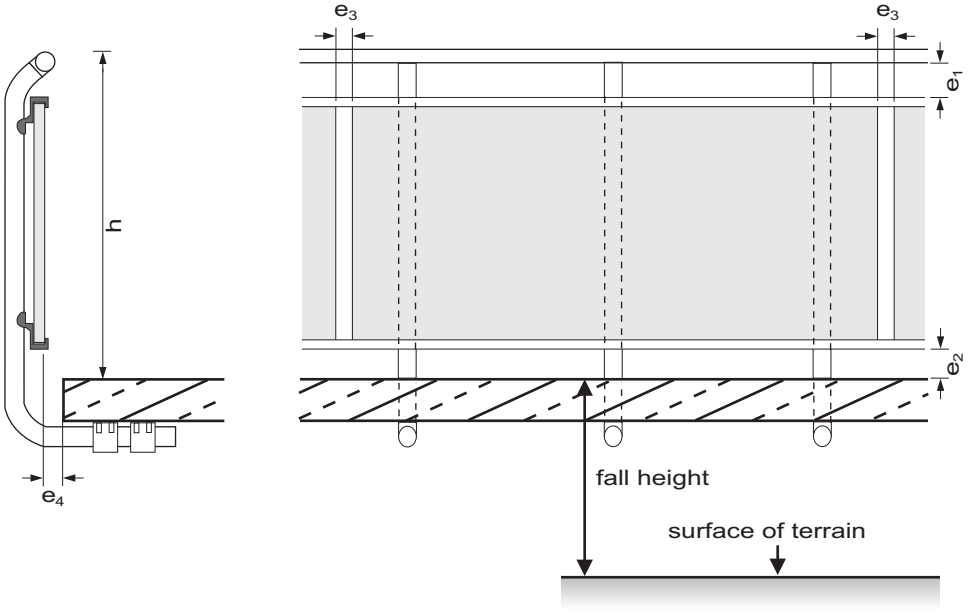
The edge profile with the inserted balcony panel is fixed by balcony rivets or screws on the inner side of the railing post directly. In other fixing methods (e.g. with spacers) the possible span width will be smaller.

Span widths and distances between fasteners

building height m	max. distance **a** mm	max. span width **s** direct fixing mm	max. span width **s** fixing with spacers mm
0 - 20	1000	850	700
>20 -100	1000	700	700

Building Heights / Open Interstices

The minimum balustrade height (h) and the maximum open interstices (from e1 to e4) are individually determined in Construction Regulations of German States. Horizontal interruptions in the cladding should be avoided, as far as possible. Otherwise, the open interstice must be ≤ 2cm. Values are valid for Germany, respect your national regulations.



fall height m	minimal height **h** m
1 - 12[1]	0,90[2]
> 12[1]	1,10[2]

[1] 6m in residental buildings the State of Brandenburg
[2] 1.0 m in the State of Baden-Wuerttemberg

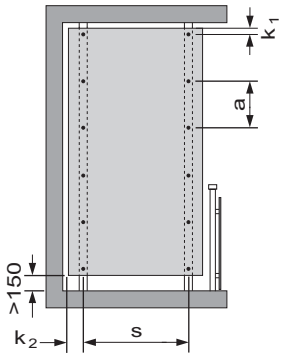
Maximal open interstices			
e_1	e_2	e_3	e_4
120mm	≤ 40mm	120mm	40mm

Use as Visual Cover

Visual covers between balconies do not serve for fall protection. However, they must withstand wind pressure and wind suction stresses in compliance with the building heights. Fixing can be done similarly to balustrade cladding. Descriptions on pages 28 - 32 are also applicable to visual covers. Open interstices “e” (see page 32) need not to be respected, if no there is no danger of falling. To enable using cleaning devices, >150 mm distance between the lower edge and the floor is recommended.

Fixing by Rivets or Balcony Screws

One-field panel

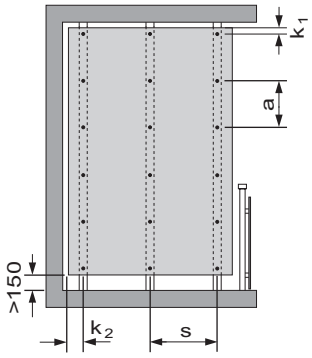


Span widths and distances between fasteners

building height m	max. **a*** mm	max. **s** mm
0 - 8	625	1100
> 8 - 20	470	850
> 20 - 100	380	750

k_1 = 80 - 160 mm
k_2 = 30 - 160 mm

Two-field panel



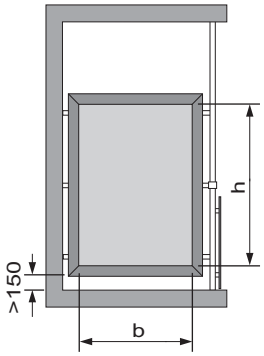
Span widths and distances between fasteners

building height m	max. **a*** mm	max. **s** mm
0 - 8	570	1100
> 8 - 20	460	850
> 20 - 100	370	750

k_1 = 80 - 160 mm
k_2 = 30 - 160 mm

* the distances **a** are valid for protrude width k_2= 160mm.
From other protrude widths, other distances may result - see the tables below.

Fixing by Frame Profiles

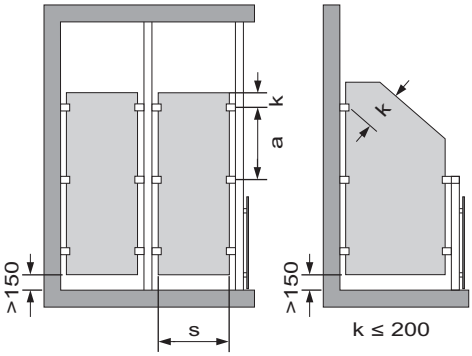


The table below is applicable for panels framed on four sides, provided that the frame profiles act as static load linear bearings. In this case, the maximal bending stress caused by wind loads, acc. to DIN 1055-4, in the panel is smaller than 6 N/mm² and deflection < b/100.

Maximal permissible panel widths (**b)** in mm

building height m	Correlation between panel height and panel width **h / b**						
	1.0	1.2	1.4	1.6	1.8	2.0	> 2.2
0 - 8	1200	1200	1200	1200	1200	1200	1100
> 8 - 20	1200	1200	1150	1100	1000	950	850
> 20 - 100	1200	1200	1000	950	900	850	750

Span Widths, Distances between Fasters and from Fasteners to Edges

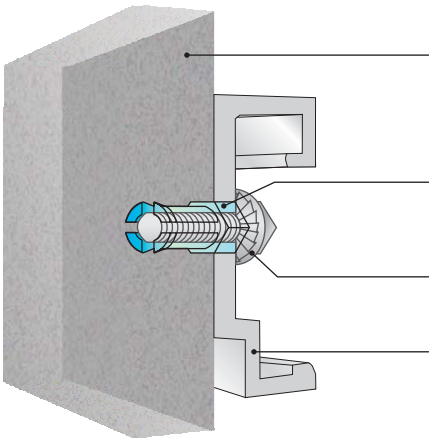


Span widths and distances between fasteners

building height m	largest distance **a** mm	largest span width **s** mm
0 - 8	800	1100
> 8 - 20	700	850
> 20 - 100	600	750

General

creaboard fibre cement panels can also be fixed with undercut anchors. Concealed fixing provides maximum possible esthetics due to clean and uninterrupted façade appearance without visible fixing points. Façades of this type intensively express high quality and value of the building.
This system allows grid planning up to the complete format size, as well. Joints can be open or backed with coated aluminium profiles. The panel are cut to size and drilled acc. to final planning or acc. to building measurements.



creaboard fibre cement panel, 12mm thickness

KEIL untercut anchor

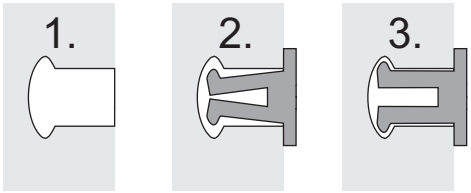
Fastening screw and washer

Holding-clamp

For concealed fixing, 12 mm thick fibre cement panels must be used.

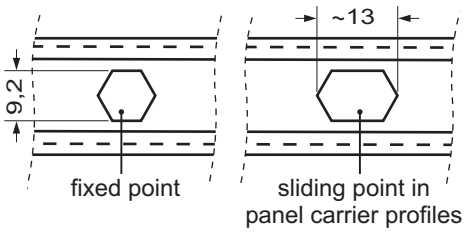
Principle

Safety of undercut fixing is ensured by form closure. By screwing a bolt into the anchor, the drill-hole widened at its base is being filled up by the anchor.



Due to a small hole diameter and a large undercut, high holding forces are achieved without to stress the panel by lateral pressure.

The undercut anchors are provided with hexagonal collars. These allow tension-free connections with parts of the substructure. Depending on the kind of fixing, punched holes for anchor collar acceptance can be made as hexagons for fixed points, or as oblong holes for sliding points.



Structure Requirements

Each façade panel must be fixed by minimum 4 rectangularly placed anchors through single holding-clamps on a suitable substructure without tensions. The number of single holding-clamps is limited to 9. If more than 9 fixing points are needed, continuous panel carrier profiles, or “clamp profiles“ must be installed.

Calculation

Each façade structure with fibre cement panels, undercut anchors and substructure has to be calculated individually. For each application, the number of fixing elements has to be computationally determined depending on the panel size, substructure, wall features and load actions (own load, wind load acc. to DIN 1055-4, or DIN 185 16-1).
For static calculations by means of FE-programs, element sizes ≥0,75d (d= panel thickness) should be selected for grid arrangement. Façade panels bending stress must be checked at the distance of 5d from the anchor axis, or from the computed stress summit. For fibre cement, the radical strain coefficient should be υ= 0.25. Carrier profiles rigidity must be considered in the calculation. Holders of the substructure are considered immovable at anchoring points in the wall.

Charactetistic		Undercut anchor	
Drilling depth	hs [mm]	8.5	
Corner distance[2]	$a_e \geq$ [mm]	50	100
Edge distance	$a_r \geq$ [mm]	50	
Perm. pulling load per anchor[1]	$F_{perm.}$ = [kN]	0.3	0.4
Perm. radial load per anchor	$Q_{perm.}$ = [kN]	0.8	
Anchor axis distance	a ≤ [mm]	750	
Hexagonal holes in clamps	[mm]	9.2 (fixed point)	
Hexagonal oblong holes in clamps	a x b [mm]	9.2 x 14 (sliding point)	

[1] For anchors under diagonal pulling loads, the permissible pulling load has to be

$$F_{perm.} = 0{,}4 \sqrt[1{,}5]{1 - \left(\frac{Q}{0{,}8}\right)^{1{,}5}}$$

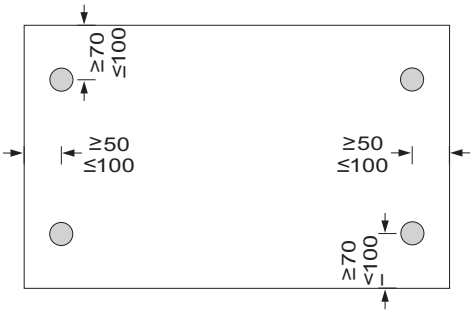
Q is the value of the radial load acting on the anchor by panels own weight.

[2] For corner distances of 50 mm ≤ a_e ≤ 100 mm, the permissible pulling load must be interpoalted. If corner distances are unequal in both directions, the smaller value is decisive.

Drill Hole Positions

Following characteristics must be considered for drill hole positioning:

- panel size
- edge distance of drill holes
- substructure type
- static proof of façade



Edge distances recommended for drill holes positioning are 100mm. Edge distances must be minimum 50mm, maximum 100mm horizontally and minimum 70mm, maximum 100mm vertically. If edge distances exceed 100mm, panel edges deviations from the surface cannot be ruled out, especially in the area of cross joints. Fixing distances can be taken from the table below as a basis for preliminary planning.

Maximum distances between undercut anchors:

Building height m	Normal area mm	Edge area mm
0 ≤ 8	750	620
8 ≤ 20	750	500
20 ≤ 100	680	420

The distances are non-binding. They must be determined by static calculations. 10mm joint width is recommended. Edge area values can be omitted if reduced wind loads can be considered acc. to DIN 18516-1, see page 13

Additional Drill Holes

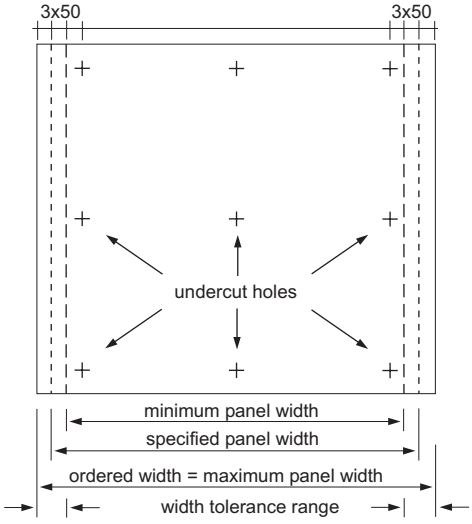
Undercut drill holes on the panel rear side must always be made with stationary machines at the factory, to achieve maximum precision and safety. If additional individual drill holes are required on site, they Can be made with a mobile drill of KEIL under workshop conditions. Remove drill-dust and check the geometry of the drill hole. If the drilled hole is incorrect, the new drill hole must be made at a distance equalling minimum the double depth of the incorrect drill hole.

For KEIL address , see page 39

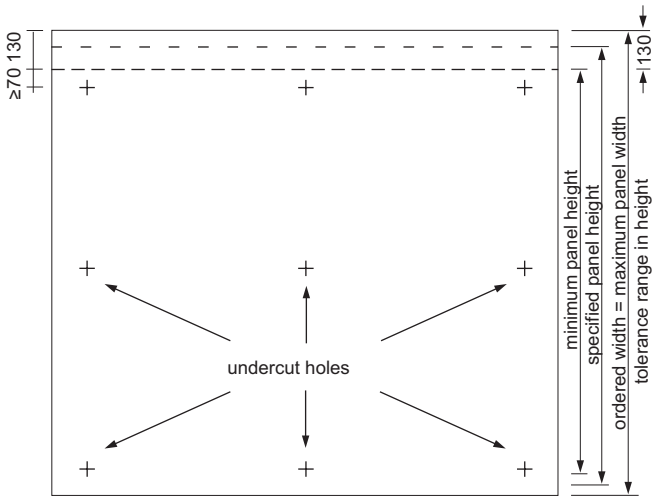
Compansation of Dimension Tolerances

Dimension deviations of the building from the specified ones can be compensated by means of fitting panels. If you expect such dimension deviations, it is better to order fitting panels beforehand. So you can avoid delays in montage and save costs.

Horizontal dimension tolerances can be compensated within the range from -100mm to +100mm. The width of the ordered fitting panels should be 100mm more than their specified width. Lateral edge distances for undercut holes is usually 100mm, however it can be from 50 to 150 mm, as well.
Edge distance should be 150 mm on the both edges of the fitting panel. Panel width can be changed by cutting fitting panel on both sides of 100 mm strips up to 200 mm width.

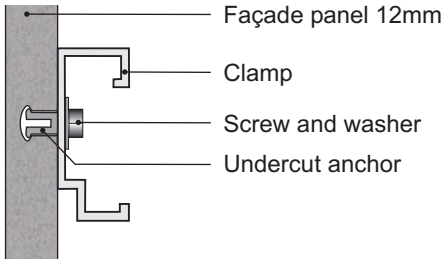


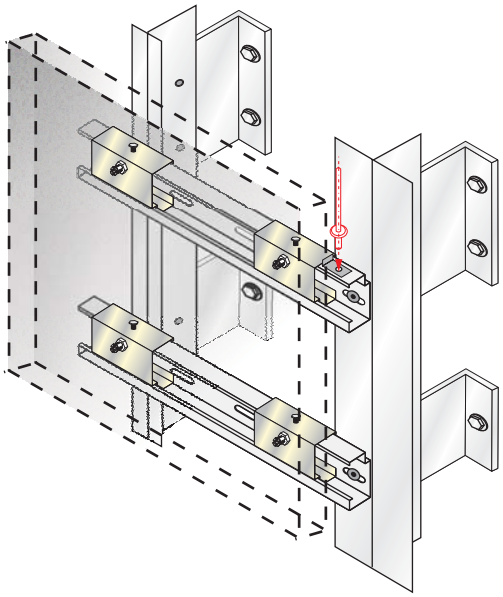
Vertical dimension tolerances can be compensated within the range of -30mm to +100mm. The height of the fitting panels to be ordered should be 100mm more than their specified height. The lateral distance from the undercut holes to the upper edge of the panel is usually 100mm, however it can be between 70mm and 200 mm, as well.
On one of two edges of the fitting panel (the upper edge in the attic area, and the lower edge in the plinth area), 200 mm edge distance should be selected. By cutting a stripe up to 130mm, panel height can be changed very easy.

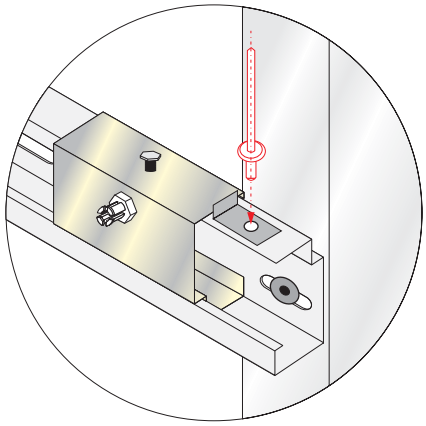


Substructure with Clamps

On the reverse side of the panel, system-compliant clamps are fixed with KEIL undercut anchors. The elements will be hooked into horizontale carrier-profiles (max. 4m) of the substructure. After the panels were aligned, they must be effectively and lastingly secured by fixtures, prescribed by the substructure manufacturer, against lateral displacement. The horizontal carrier profiles must be interruped every 4m to avoid joint differences between the panels caused by large extension of the aluminium profile. The own weight is always transferred via two adjustable fixing points. The minimum distance from the front edge of a 12 mm thick façade panel to the wall is 100mm.

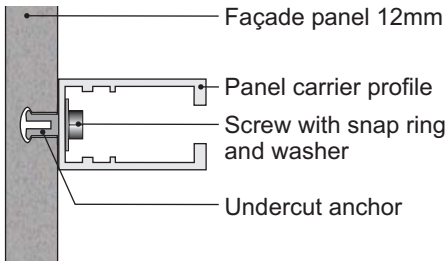


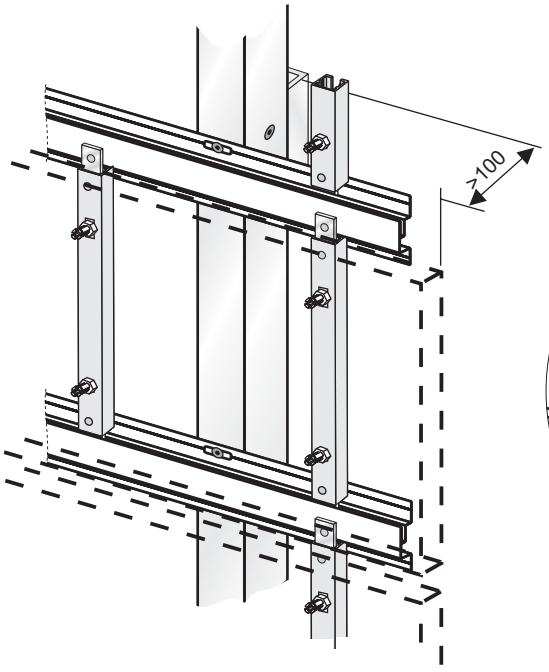


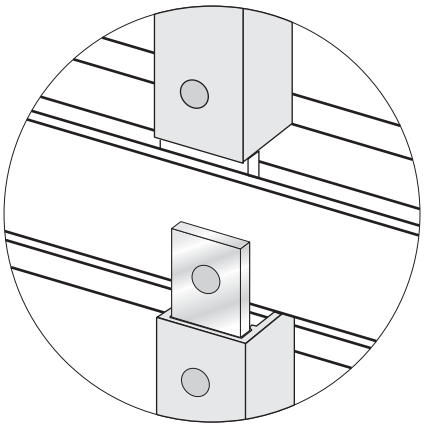


Substructure with Carrier Profiles

On the reverse side of the panel, carrier profiles are fixed by KEIL undercut anchors without tensions. After the panels are adjusted, the elements prepared in such a way are fixed to the carrier profiles of the substructure through the joints. The system also allows to change panels quickly and easily. The own weight is always transferred via two fixing points. At substructures with carrier profiles for panels, a snap ring must be installed between the undercut anchor and the washer on sliding points according to DIN 7980-A2. The snap rings are supplied by substructure manfacturers.

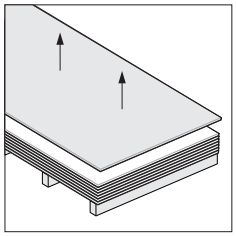




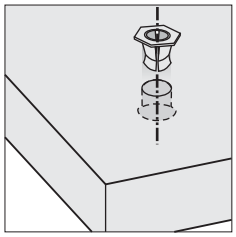


System suppliers of substructures > see page 39
Panel carrier profiles are offered by BWM:
ATK 103V
System: type UBEKA
WS Fassaden: UP24/Tergo

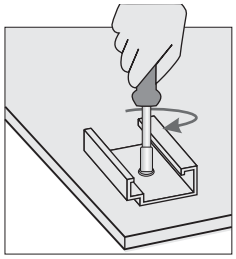
Special Notes



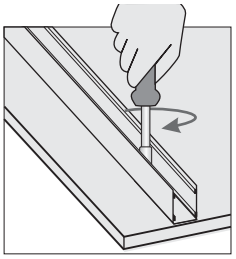
Always lift the panels up from the pile, do not pull them off! Protect panels from humidity and direct insolation!



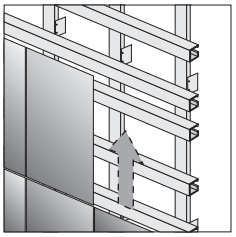
Insert the undercut anchor into the factory-made drill holes



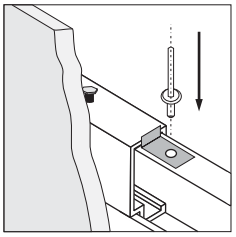
Fix the clamps with washers on the reverse side of the panel
(Screw torque is 2.5-4.0 Nm)



Fix panel carrier profiles with snap ring and washers on the reverse side of the panel. At sliding points, a snap ring must be installed between the undercut anchor and the washer acc. to DIN 7980-A2.



Mounting of panels is usually done from below upwards.
Important: Store panels with mounted clamps or carrier profiles in vertical position and protect their front sides from contacting with reverse sides.



For mounting with clamps: Align the panels and secure them against displacement according to instructions of the substructure supplier.

Suggestion for Use

There are three important components on a mullion-transom construction:

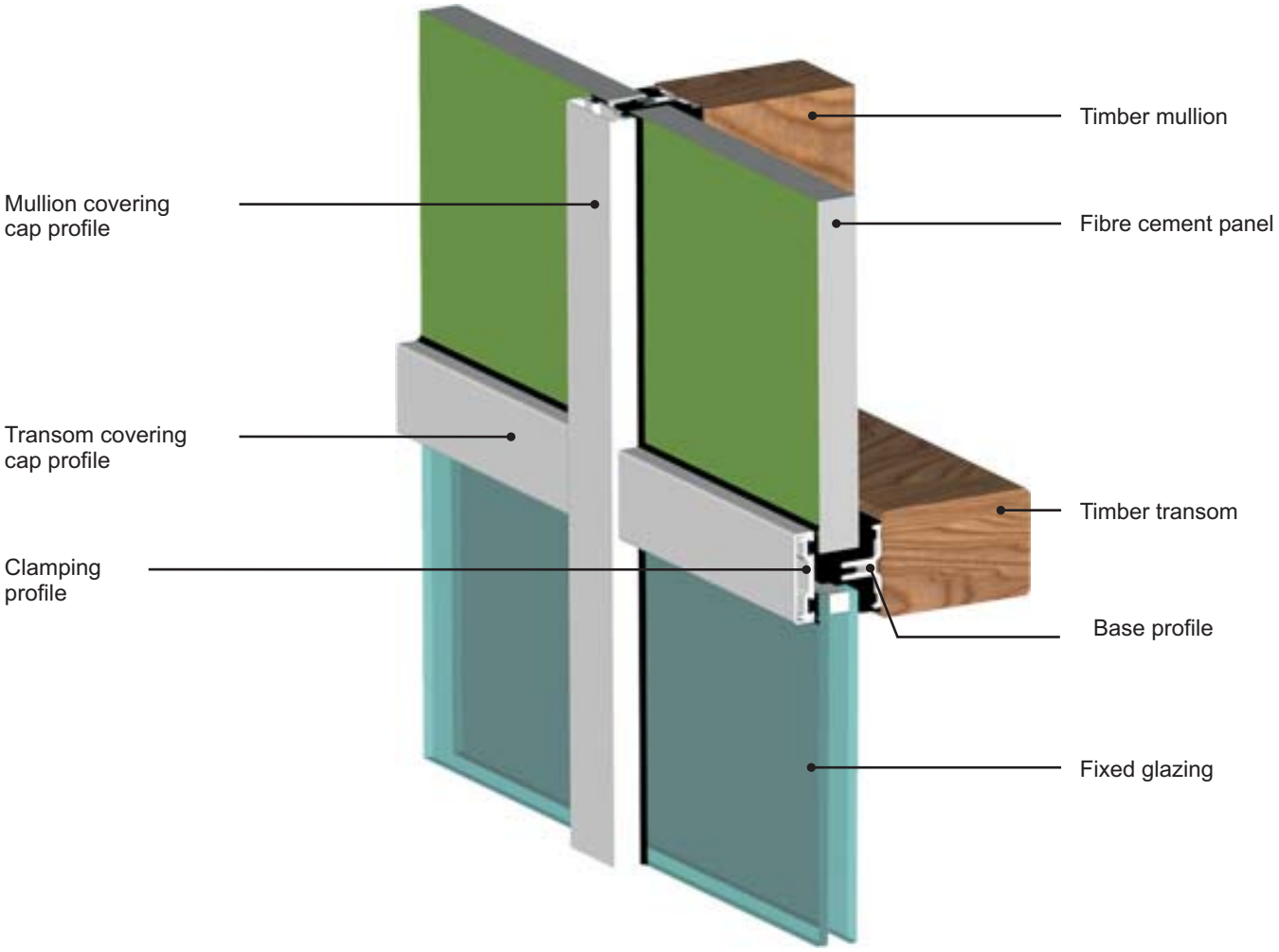
- vertical mullion profiles
- horizontal transom profiles
- glazing / filling

Two-part mullion and transom profiles are usually made of aluminium. Besides design purposes, they are also needed for mounting windows and doors, as well as fillings. It is also possible to build structures of timber and steel load-bearing elements and mount the profiles on.

Mullion-transom profiles are offered in diverse shapes depending on static and design requirements. Filling can be made of diverse materials. Besides various options of glazing, fillings made of fibre cement are also recommended, especially in areas between storeys.

Using creaboard fibre cement as filling material has an advantage of almost unlimited color and effect range, fire protection, weather resistance and statical properties.

The structure can be made as a cold- or warmth-façade. In a cold façade, thermal insulation is separated from cladding. A classic example of a cold façade is a ventilated curtain wall.
In warmth-façades, thermal insulation and cladding form one component. In this case of mullion-transom construction, fibre cement panels are provided with thermal insulation and inside covering (aluminium or steel caisson, or fibre cement panel as well).



The illustration shows a cutout from a mullion-transom construction with 2 fixed glazings and 2 fillings made of fibre cement. Fibre cement panels can be used as filling up to their maximal net-sizes.

Maximum panel sizes without additional visible or invisible fixing in the middle

panel thickness	building height m	normal area mm	edge area mm
8mm	0 - 8	1000 x 1300	800 x 1000
	> 8 - 20	1000 x 1000	800 x 800
	> 20 - 100	800 x 1000	700 x 700
12mm	0 - 8	1250 x 3100	1250 x 1500
	> 8 - 20	1000 x 2800	1000 x 1400
	> 20 - 100	1000 x 2000	1000 x 1100

The values above were determined under following conditions:
Permissible bending stress < 6 N/mm² ; permissible deflection < l/200

Substructures

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Fax: 07225 / 9 77-111
E-Mail: info@protector.com
Internet: www.protector.com

Insulation

Deutsche Rockwool Mineralwoll GmbH
Internet: www.rockwool.de

Saint-Gobain Isover G+H
Internet: www.isover.de

Construction Site Equipment

Festool separating saw AXT 50 LA
With saw guides
Internet: www.festool.de

mafell Plattensägen-System PSS 3100 SE
Internet: www.mafell.de

Riveting Tools

Gesipa Blindniettechnik GmbH
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MEA MEISINGER AG
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Literature

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