Perfect assembling

of timber glass-composite units

OTTO CHEMIE

Sealants • Adhesives

THE OTTO BUILDING WITH TIMBER-GLASS-COMPOSITE UNITS

Photo credits: SUPERLAB – Design Solutions / Dold und Hasenauer OG

Preface

Modern architecture is increasingly demanding building shells that visually bring the outside in and vice versa. This in turn means that the importance of glass is growing.

Another advantage of using glass in a building shell are the solar heat gains that can account for a large proportion of a house's energy usage. With the latest design passive houses, the solar energy input can make a conventional heating system unnecessary, bringing with it huge savings.

On the technical side, extremely high demands are made of the rigidifying effect large glass surfaces have on the building. Conventional structures to date always resulted in elaborate and expensive constructions or in solutions that detracted from the look. In bonded glass façades, the glass assumes no load-bearing function.

The benefits of timber-glass composite units are:
- Heavy loads can be introduced into the sheet of glass
- Buildings can be rigidified with glass
- They offer significant benefits in terms of structure and installation
- They open up new architectural possibilities

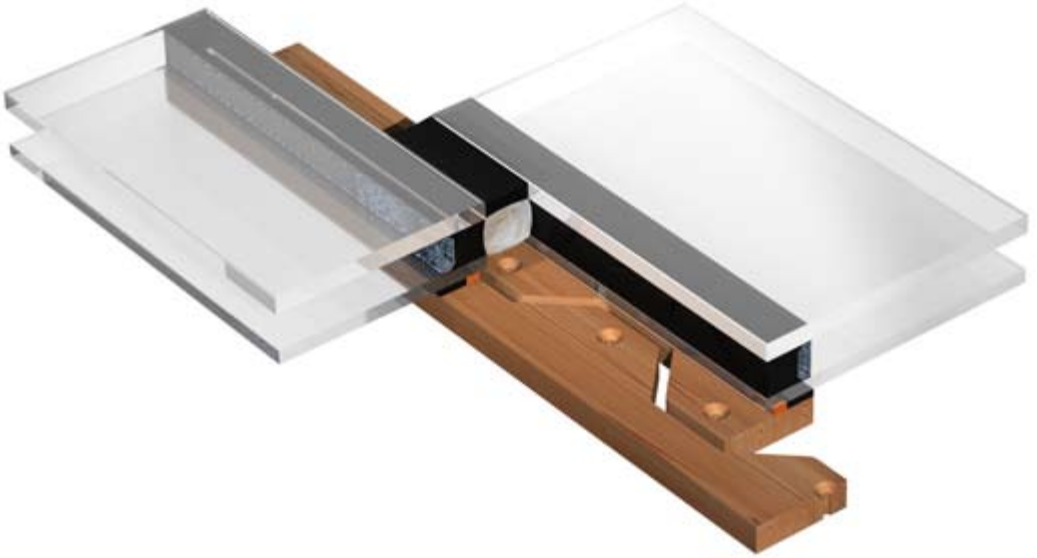
The following description is an abbreviated summary by the HFA research project and Vienna University of Technology for the use of wood-glass composite elements.

Which kind of buildings are suitable for the use of timber-glass composite units?

In general, buildings should not exceed two storeys in height and 7 m eaves height. Detached, semi-detached and terraced houses suitable for conservatories and extensions therefore lend themselves to this.
The precise requirements for the building are defined by the structural design of the entire building, the post-and-beam construction and the joining means. The supporting structure of the such as a post-and-beam structure, must be non-settling so as to avoid residual stress to the timber-glass composite units due to settlement.

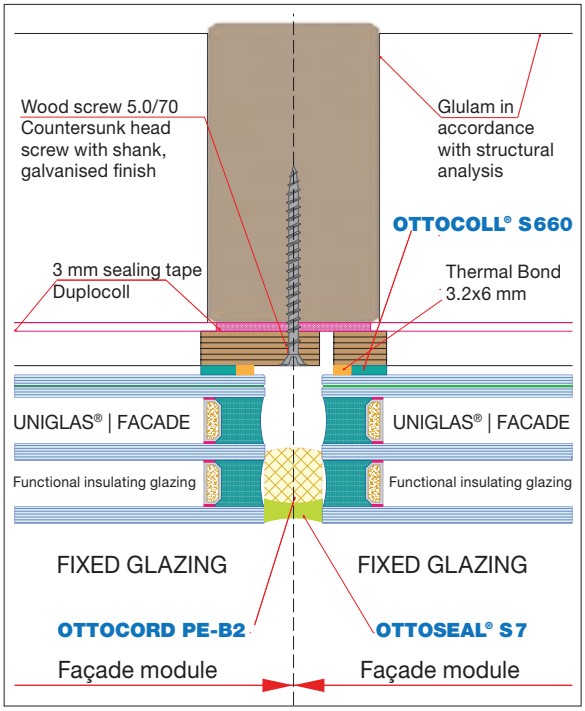
What requirements are made of the timber-glass composite units?

- Wood and glass take on a load-bearing role in the building shell. This means that unsatisfactory wind bracing used for rigidifying buildings can be formally dispensed with.
- The adhesive bond between wood and glass provides the requisite load-bearing structure.
- Timber-glass composite units adapt to a wide variety of structural requirements.



Design of a WGC element source: Uniglas

Façade system with wooden couplers in accordance with EN 636-2, adhesion class 3 in accordance with EN 314-2



Design of timber-glass composite units *Source: Uniglas*

Adhesive tape (Thermalbond V2100)

Applying the 2C silicone for wood-glass composite elements

What requirements are made of the materials?

The glass panes

Minimum thickness of the inner glass pane
- 8 mm for float glass or semi-tempered glass
- 2 x 4 mm and 1 x 0.76 PVB for safety glass

Float glass, semi-tempered glass or safety glass (depending on building law requirements) as a supporting pane

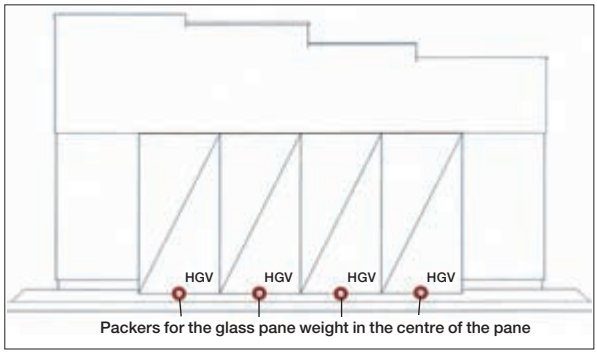
Description	Measurements lying or standing
Maximum length of the longer glass edge	3.5 m
Minimum length of the shorter glass edge	1.0 m
The length-to-height ratio of the glass pane	L / H = (1:1) to (2:1)

A bonded coupler is attached circumferentially around all four glass edges, which is evenly screwed to the supporting structure. The glass is made of 2- or 3-pane insulating glass with a supporting edge seal in accordance with EN 13022-1.

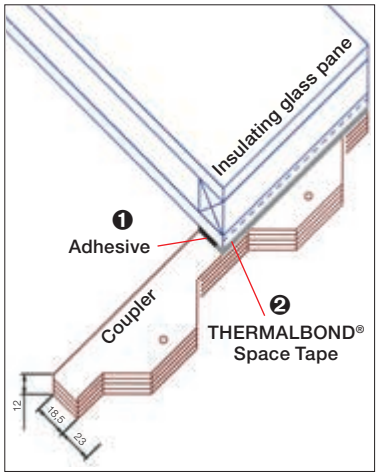
The assessment of the glass pane under load (e.g. wind pressure or suction) must be done in accordance with the applicable standards (e.g. by glass manufacturer).

The anti-derailment device must be provided by mechanical fasteners.

The load transfer of the glass weight is done either by packers in the centre of the pane, since the relative motion of the pane to the support structure when functioning as a rigidifying element is the lowest here, or by adhesion where permissible in building codes.



Load transfer *Source: Holzforschung Austria*



View of the coupler
Source: Holzforschung Austria

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OTTOCOLL® S 660

OTTOCOLL® S 660 – The 2C silicone special adhesive

Proof of the tests must be established in accordance with the “Basis for assessing bonded glazing systems” guideline. The requirements profile describes bonds at position 4 of the pane structure, bond variant V8.

The linear shear modulus must be determined longitudinally and transversely to the glue line, in addition to the tests required by the guideline.

The cyclic load tests must be determined at a reference level of $R_{u,5}/3$ in both shear directions in five tests each, taking into account ETAG 002, without any resulting reduction in tensile strength or rigidity.

Continuous load tests (creep formation after 91 days) must be carried out and evaluated under a continuous shear stress of ($R_{u,5}/15$) under 20 °C / 65 % RF and at 55 °C.

The wooden coupler

The coupler must be made from birch veneer plywood (in accordance with EN 636-2, adhesion class 3 in accordance with EN 314-2) and be at least 12 mm thick. Other materials such as fibreglass must be qualified separately.

The top layer of the veneer runs along the coupler axis (parallel to the glass edge). Interlocking geometry means that a narrower visible width can be achieved. For wider visible widths, the coupler can also be finished without interlocking.

It is necessary to coat the coupler (e.g. with thick wood varnish), however the adhesion point must remain uncoated.

Screws must be applied at least every 120 mm. Do not allow humidification of the coupler exceeding 18 % wood moisture content.

A 5 mm joint is purposely sealed using **OTTOCOLL® S 660** to achieve a rainproof corner. Coating the surfaces must be done after cutting.

Coupler surface coating

Construction timber for the façade (post-and-beam construction)

The minimum quality of the grade is C 24 for solid wood and GL 24 for glulam. Wood and wood-based materials must comply with the applicable standard or be authorised for the supporting application. The minimum width of the posts and beams in the façade structure is at least 60 mm.

What requirements are made of the finish?

Planning

Specific approval is required for the use of nonregulated components in Germany.
A structural analysis of all components relevant to the stability and load-bearing capacity of the building must be carried out. In Austria, as well as in all other countries, a permit from the buildings authority is required.

The “Constructions with timber-glass composite units” research report from Holzforschung Austria may be used for the necessary proof of suitability.

The glass construction must be chosen according to building code and structural requirements. If the weight of the glass pane is transferred via the adhesive, this must be shown by means of calculation. OTTO can carry out this calculation. A blueprint must be produced before manufacturing the timber-glass composite units in order to ensure that adjacent elements can interlock with one another.

Design of timber-glass composite units
Source: Uniglas

A parts list for the individual couplers can be derived from these drawings. Condensation must be accounted for.
A mechanical safety device must be provided for the event of failure. Both visible and concealed solutions are possible.

MSS visible mechanical safety device (Petschenig)

Requirements for the glue line

The width-to-thickness ratio of the glue line is T / W = (1:2) to (1:6). The minimum width of the glue line is 10 mm and the maximum width is 20 mm. The minimum thickness of the adhesive is 3 mm; length changes in the system related to temperature or moisture must be absorbed without causing damage.

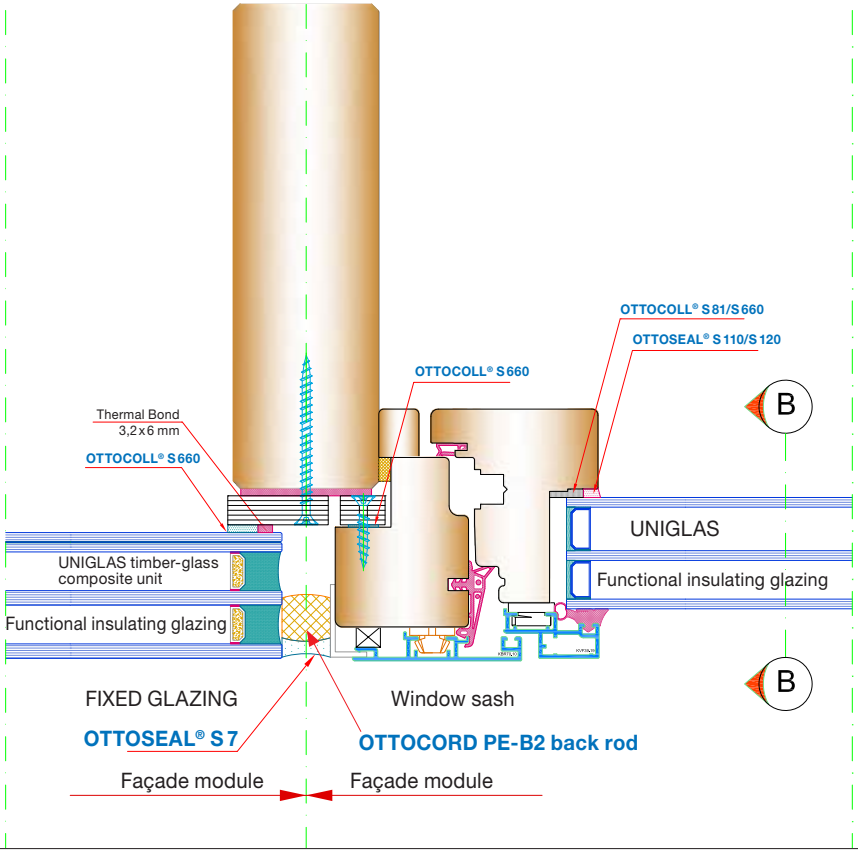
The circumferential continuous bond must have the same adhesive dimensions at all four glass edges. The bond must be made free of cavities or bubbles. It must be done at the factory and may not be carried out on-site.

Load transferring packer (Petschenig)

Manufactureing of the timber-glass composite units

In general, manufacture must be done under controlled conditions by qualified personnel. In production, the coupler is bonded to the pane using a double-sided adhesive tape suitable for safety glass applications (see page 7, item 2 in the drawing), thus accurately placing the glass in position with the correct spacing. This also creates a clean finish on the interior side, i.e. on the glass side. The remaining glue line is filled with **OTTOCOLL® S 660**. Processing guidelines must be followed in this, such as complying with the curing time before further work on the element. Quality assurance for the bond must be done in accordance with ETAG 002 or the manufacturer's instructions. H-tests and peel tests must be carried out during production. Bond production must be subjected to internal and external quality checks.

Timber-glass composite with built in window section



Horizontal section of wall joint

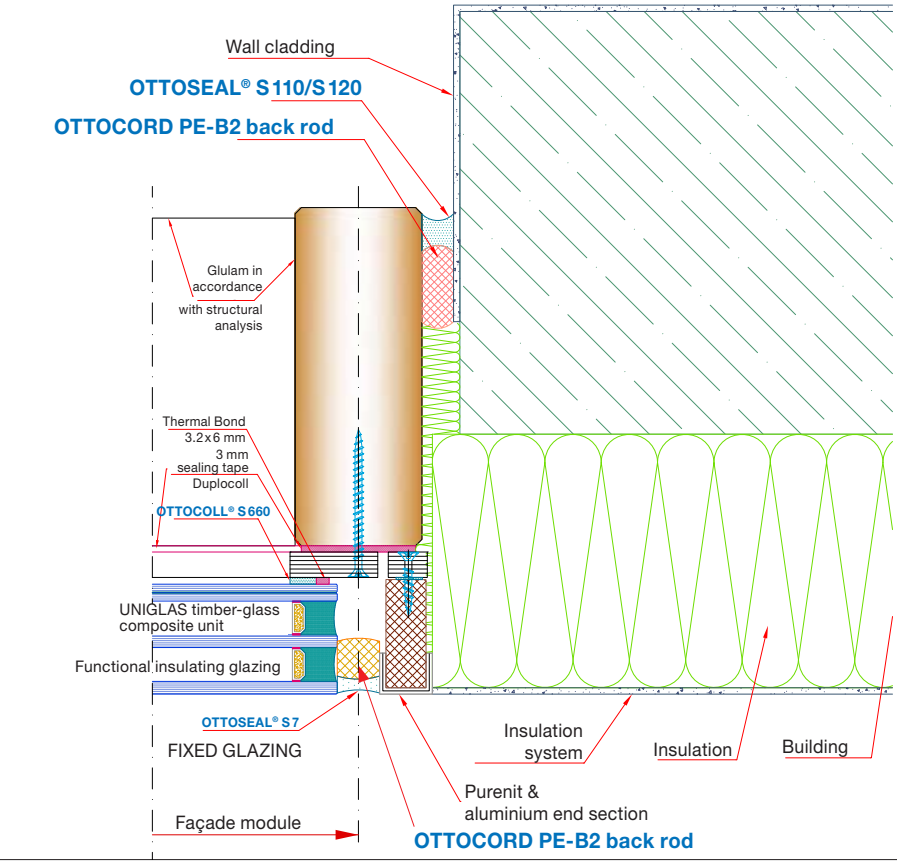
Installation

A pre-compressed sealing tape is applied to the post-and-beam structure when installing, to establish air- and water-tightness and a vapour barrier. Unintended moisture penetration to the elements should be avoided during installation.

The post-and-beam structure must be prepared and made flush and even, to prevent distortion to the timber-glass composite unit during installation. The timber-glass composite unit is screwed to the post-and-beam structure without damaging the glass substrate. After finishing installation, the joint is sealed from the outside with an **OTTOCORD PE-B2 back rod** and **OTTOSEAL® S 7**. A minimum of 10 mm must be left between the coupler and the backer rod to allow any condensation to drain. A suitable vapour pressure equalisation opening must be provided in the glassing at the head and foot of each vertical joint, so as to ensure the drainage of moisture.

Installation can be done either by incorporating each individual timber-glass composite unit on-site, or by installing and sealing the wall structure in the factory and inserting the finished design on-site.

Wall connector post flush with insulation system



Horizontal section of wall joint

OTTOCOLL® S 660

The 2-component silicone for timber-glass-composite elements

Characteristics:

- Neutral, condensation curing 2-component silicone adhesive and sealant based on alkoxy
- Extremely UV-resistant, crack and notch resistant
- Non-corrosive
- Excellent adhesion on glass and wood
- High expansion-tension value guarantees high stability bonding
- Cures at room temperature
- Minimal odour nuisance
- Reduced cycle times - due to the fast curing bonded parts can be further processed extremely soon
- High mechanical capability
- Low shrinkage during vulcanization (approx. 4 %)
- Very good temperature resistance
- Excellent resistance to water and moisture

Fields of application:

- Bonding of timber-glass-composite elements
- Elastic bonding and sealing of various materials, e. g. glass, wood, metal and plastics

Standards and tests:

- Certified according to GOS

Compressed Air Gun P 495 DP

- Compressed air gun for the use of side-by-side cartridges 490 ml. Special pistol for increased product discharge

OTTOSEAL® S 7

LEED®

The weather sealing silicone

Characteristics:

- Neutral-curing 1-component silicone sealant
- Excellent weathering, ageing and UV-resistance
- Long skin-formation
- User-friendly matt surface
- High resistance to notches, tension and tearing
- Excellent adhesion on many substrates, partly in combination with primer
- Compatible with PVB-foils according to the criteria of the ift-guideline DI-02/1
- Compatible with insulating glass edge bond sealing based on silicone
- Non-corrosive

Fields of application:

- Specially developed for the weather sealing of structural glazing, angled glazing, timber-glasscomposite elements, roof glazing and conservatories
- Suitable for sealing glazing units
- Suitable for joints on insulating glass units

Standards and tests:

- According to the requirements of DIN 18540-F
- According to the requirements of ISO 11600 F 25 LM
- Suitable for applications according to IVD instruction sheet no. 22 (IVD = German industry association sealants)
- Conform to LEED® IEQ-credits 4.1 (Indoor Environmental Quality) adhesives and sealants
- Fulfills DGNB-characteristics 06 (DGNB e.V. = German Organisation for sustainable building)
- French VOC-emission class A+
- Certified according to GOS

OTTOSEAL® S 7 580 ml aluminium foil bag

OTTOSEAL® S 9

The 1-component insulating glass edge sealant

Characteristics:

- Neutral-curing 1-component silicone sealant and adhesive
- Excellent weathering, ageing and UV-resistance
- Excellent adhesion on many substrates, partly in combination with primer
- High resistance to notches, tension and tearing
- Compatible with spacers made of aluminium and stainless steel
- Non-corrosive
- Compatible with PVB-foils according to the criteria of the ift-guideline DI-02/1

Fields of application:

- Secondary edge sealing for manufacturing UV-resistant insulating glass units in connection with butyl rubber as primary sealing

Standards and tests:

- Tested according to EN 1279, part 2 with gas-filled multi-panel insulating glass with spacers made of aluminium and tested according to EN 1279, part 4, paragraphs 5.1 and 5.2 by the MPA Darmstadt, Germany
- French VOC-emission class A+
- Certified according to GOS

Novasil® S 42

The 2-component silicone for insulating glass edge sealing

Characteristics:

- Neutral, condensation-curing 2-component silicone adhesive and sealant based on alkoxy
- Excellent adhesion on many substrates, partly in combination with primer
- Excellent weathering, ageing and UV-resistance
- Compatible with spacers made of aluminium, stainless steel and plastic
- High resistance to notches, tension and tearing
- Non-corrosive
- Low odour
- Compatible with PVB-foils according to the criteria of the ift-guideline DI-02/1

Fields of application:

- Secondary edge sealing for manufacturing UV-resistant insulating glass units in connection with butyl rubber as primary sealing
- Not suitable for the structural bonding of structural glazing units

Standards and tests:

- Tested according to DIN EN 1279, part 2 with air-filled multi-panel insulating glass with spacers made of stainless steel, by the ift Rosenheim, Germany (institute for window techniques)
- Tested according to GuP (German quality association for multi-panel insulating glass) with spacers made of aluminium, stainless steel and plastic

OTTOCORD PE-B2

The closed-cell PE back-up foam rod

Characteristics:

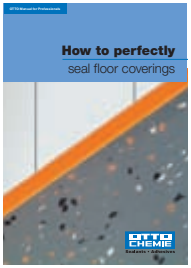
- Extruded backfilling material made of polyethylene (PE)
- For application in interior and exterior areas
- Closed-cell according to DIN 18540
- Water-repellent
- According to building material class B2

Fields of application:

- Backfilling of joints in interior and exterior areas
- For building construction joints according to DIN 18540

Standards and tests:

- Tested according to DIN 4102-B2 - normally flammable



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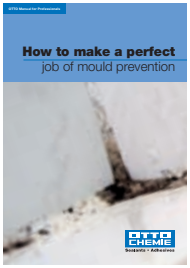

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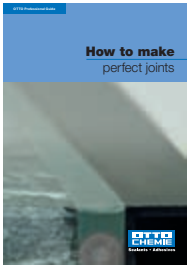

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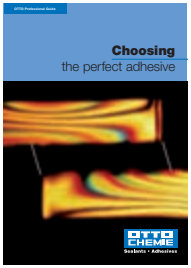

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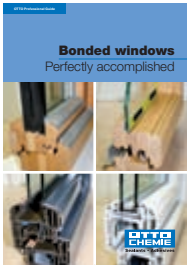

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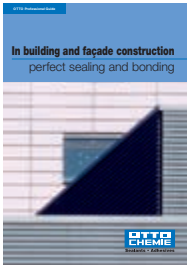

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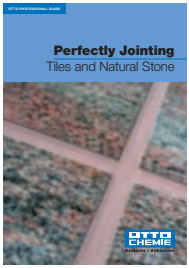

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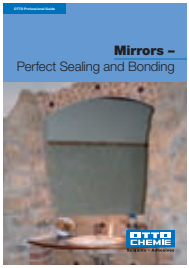

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