Composite Glazing
The unique building skin made from glass-fibre elements and glass.
Two unique materials – in a new combination

Insulating glass: the high-performance weather shield

Modern multi-layer insulating glass fulfils the most exacting and various requirements. It combines heat, sun, sound and fire protection, affords the highest possible level of security and is highly light permeable. It thus achieves all the peak values demanded for innovative building projects: $U_g$ values of 0.4 W/m²K and sound insulation values of up to 50 dB are today easily attainable.

And all that without wasting a lot of space: values of this order call for thicknesses of around 20 and 40 cm in an insulated wall construction! Insulating glass on the other hand needs just 40 mm. The installation depth required is correspondingly low. Insulating glass is a tried and tested, stable high-performance building material researched over many years. In short: a material with a bright future.

Glass-fibre reinforced plastic: the slimline support

Glass-fibre reinforced plastic (GRP), more commonly known as fibreglass, is used for wind energy components, as a support in bridge-building and recently also for window profiles. In other words, wherever its exceptional properties are called for:

- low weight
- outstanding static load-bearing capacity
- adequate elasticity
- high corrosion and chemical resistance
- hygiene
- low thermal conductivity

Innovative: the self-supporting insulating glass element

If the two high-performance building materials glass and glass-fibre reinforced plastic are combined together, the result is an element with unique properties: self-supporting insulating glass. Slim profiles are adequate to withstand high loads. The result is improved heat insulation with a simultaneous increase in incident light.

The elements are preassembled in the factory ready for installation. On site, they are simply installed on the support structure. This enables the construction time to be cut considerably.
Attractive and versatile
Our specialists ensure that the elements are delivered to the building site ready for installation. They cut them to the correct length, machine edges and drill holes. No further finishing work on the material is required before installation. No problem therefore for the majority of contractors to install the system quickly and easily.

The following standard profile colours and surface finishes are available:

- **Standard resin P2600**
  - Colour: white
  - Surface: smooth

- **Fire-protection resin P4518**
  - Colour: natural green
  - Surface: textured

The profiles can be coated with many different paints.
Tough as an ox and light as a feather

Glass-fibre reinforced plastic: the manufacturing process

GRP consists of approximately 70% glass fibres. These fibres are aligned and unidirectionally bonded with special polyester-based or epoxy-based resin in a pultrusion process. The result is a material with high strength and low density. The GRP material we employ is resistant to UV light and harmless to health and the environment.

The GRP manufacturing process (pultrusion)

Long lasting and maintenance free

The material properties of GRP are comparable with those of glass. This makes GRP especially suitable for applications in combination with glass. Once installed, GRP requires no further treatment or maintenance. Like glass, GRP is resistant to corrosion and chemicals, ages extremely slowly and has good hygienic properties: GRP is water, oil and dirt repellent and easy to clean.

Technical parameters of GRP in comparison to glass and other commonly used frame materials

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Float glass</th>
<th>Steel</th>
<th>Aluminium</th>
<th>Wood</th>
<th>GRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density [kg/m³]</td>
<td>2500</td>
<td>7800</td>
<td>2800</td>
<td>600</td>
<td>2400</td>
</tr>
<tr>
<td>Thermal conductivity [W/m²K]</td>
<td>1.00</td>
<td>50.00</td>
<td>160.00</td>
<td>0.14</td>
<td>0.35</td>
</tr>
<tr>
<td>Coefficient of thermal expansion [10⁻⁴/K]</td>
<td>9</td>
<td>12</td>
<td>23</td>
<td>3–6</td>
<td>9</td>
</tr>
<tr>
<td>Permissible bending stress [N/mm²]</td>
<td>50</td>
<td>235</td>
<td>160</td>
<td>0.05–15</td>
<td>240</td>
</tr>
<tr>
<td>Modulus of elasticity [N/mm²]</td>
<td>70000</td>
<td>210000</td>
<td>70000</td>
<td>230–20000</td>
<td>10000–45000</td>
</tr>
</tbody>
</table>

Left:
Installation of roof glazing, Fiberline Composite A/S in Middelfart, Denmark
Cost effective and environment friendly
Modular, simple construction

Composite glazing is a valuable addition to conventional stick systems in metal or wood. The striking feature of the system is its simplicity: the GRP profile is bonded to the insulating glass element using a high-performance two-component adhesive, making it self-supporting. Only the glass surface can be seen in the visible facade.

Composite glazing satisfies the most stringent technical and aesthetic requirements:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Fast installation</td>
<td>One element is installed in 1 hour</td>
</tr>
<tr>
<td>High light incidence</td>
<td>Thanks to small frame proportion</td>
</tr>
<tr>
<td>Large elements</td>
<td>Elements of up to 3.0 x 7.5 m (22.5 m²) are possible</td>
</tr>
<tr>
<td>Outstanding thermal insulation</td>
<td>Small frame proportion and low frame U-value</td>
</tr>
<tr>
<td>Attractive design</td>
<td>High-tech material</td>
</tr>
</tbody>
</table>

Cost-effectiveness

All components are cut to size and assembled in the factory. On site, the prefabricated elements are simply installed on the support structure, for example on steel plates. Preassembly and short installation times help reduce construction costs. Once installed, composite glazing is virtually maintenance-free. Because the elements have a low heat transmission, the energy costs are also lower than with comparable systems: a contribution to lower building operating costs.

Sun protection

Although heat insulation in winter is important, keeping summertime heat at bay is also a significant consideration. If this cannot be ensured with solar control glass alone (low g-value) or internal blinds, the planner will need to allow for external sun protection. Slim support profiles for sunblind guide rails can be provided in the joints for this purpose.

Ecology and sustainability

Glass consists of natural raw materials such as quartz sand, chalk and soda, GRP of glass fibres and hybrid resin – that is to say, materials that are neither environmentally hazardous nor detrimental to health. Moreover, its recycling via Compo-Cycle, the pan-European GRP recycling system, is cost-effective and ecologically sound.
The planners of the new Aarekies Aarau-Olten AG gravel plant in Buchs AG chose composite glazing. To install the elements, a support structure of steel angles was fitted first. The individual elements, produced in Bützberg and brought to the construction site by inloader truck, are installed with the aid of a mobile crane and powerful vacuum unit; the screw joint remains visible. Half an hour to one hour per glass element (2.47 × 6.35 m) is sufficient. All that then remains is to seal the outer joints – and the glass facade is finished!
Persuasive from the building physics perspective
Lower energy losses

The composite element enables an optimum thermal joint to be achieved. In contrast to conventional frame constructions, the heat insulating layer of the insulating glass is not interrupted; the inside surface temperatures remain high. The element joint exhibits an outstanding frame U-value $U_f$ of 0.8 to 1.0 W/m²K (in accordance with EN ISO 10077-2).

The result of a calculation on an element of 1.2 x 2.8 m with constant glass U-value $U_g$ of 0.5 W/m²K, shows around 15% lower energy losses compared to a conventional stick system in aluminium [see diagram right]. A decisive argument with passive house projects!

Outstanding noise insulation

Thanks to its elasticity and relatively high density, GRP possesses outstanding noise insulation properties. Since the profiles are bonded from the inside, noise is unable to penetrate the building at the butted joint: a perfect solution for protection against extraneous noise.

If an internal partition wall is attached to an element, an impressive airborne sound insulation through the butted joint $R_w$ of up to 60 dB can be achieved.

Thermal comfort

GRP has a lower heat emission than metal, that is to say, it gives off less energy (heat or cold) to the room, resulting in better thermal comfort. An important contributory factor is of course the quality of the insulating glazing.
Maximum element size
Sizes

Elements can be produced to individual sizes. The decisive factor is the maximum element size in which the glass is delivered. Angled and oblique shapes are also feasible.

The profiles will be dimensioned by a specialist engineer or facade consultant in order to meet the local building requirements in terms of wind loads.

<table>
<thead>
<tr>
<th>Type</th>
<th>GRP profile dimensions</th>
<th>Maximum element sizes</th>
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</thead>
<tbody>
<tr>
<td>STIG 1</td>
<td>105 × 16 mm</td>
<td>to 1500 × 3000 mm</td>
</tr>
<tr>
<td>STIG 2</td>
<td>155 × 16 mm</td>
<td>to 2000 × 4500 mm</td>
</tr>
<tr>
<td>STIG 3</td>
<td>225 × 16 mm</td>
<td>to 2500 × 6000 mm</td>
</tr>
<tr>
<td>STIG 4</td>
<td>295 × 16 mm</td>
<td>to 3000 × 7000 mm</td>
</tr>
</tbody>
</table>

Ventilation windows

Opening windows and solid panels can be realised in various ways – depending on customer wishes and individual requirements.
Panorama and giant display windows are popular architectural design elements. They enable rooms to be flooded with natural light and at the same time open up an incomparably broad perspective to the outside world. The construction of a panorama window used to be a very expensive proposition – with all the disadvantages of a one-off manufacture. These include for example higher expenditure on planning and execution, higher costs, greater risk, etc. These disadvantages are ingeniously overcome with preassembled composite glazing. The energy balance of this construction is in a class of its own: thanks to the almost non-existent frame component, heat losses are reduced to the minimum and the solar gain maximised.
No thick, intrusive frames are required. Essentially, it consists of frameless fixed glazing that is particularly well suited for filigree constructions with large glass areas.

The design possibilities are extremely diverse. The panorama window may be installed flush or recessed (see diagram alongside).

The system can also be installed horizontally on flat roofs, enabling an extremely delicate solution with a lot of natural light from above.
Able to withstand wind pressure and wind suction

The performance of the composite element under wind load was tested by Ift in Rosenheim (test report Ift 104 38788/1+2). In addition to the behaviour caused by bowing under load, the effect of pressure-suction interactions was tested.

Fire protection

Glass-fibre reinforced plastic is classified as difficult to ignite. The behaviour of glass-fibre reinforced plastic in fire is similar to that of wood: although the material is combustible, in contrast to all metals, it retains its structural strength for a long time in the event of fire.

The fire index number is declared as B-s3, d0 (in accordance with standard EN 13501). Here:
- B = difficult to ignite
- s3 = substantial smoke production
- d0 = no flammable drops

The applicable fire prevention requirements and the means of adhering to them should be clarified on a building-by-building basis.

Tensile and shear strength of the adhesive bond

The adhesion of the compound was also exhaustively tested and verified by Ift (test report Ift 507 35813). The two-component adhesive bonding employed satisfied all requirements placed upon it under thermal (from –20 to +80°C) and various static loads.

"And that’s strong enough ...?"