

Custom-fabricated glass fibre-reinforced plastic profiles for window structure applications in the latest generation of double-deck trains produced by Stadler Rail AG

High mechanical strength is one of the key characteristics frequently cited for construction elements. Additionally, advantages of the Angst+Pfister solution include low weight, thermal insulation, fire protection plus high corrosion and chemical resistance.

The globally operating Stadler Rail Group develops and manufactures innovative mass transportation vehicles. In addition to city, regional and suburban rail transport, the group's area of operations has recently expanded to include inter-regional and intercity rail vehicles. Stadler Rail's modular vehicle families built using aluminum lightweight construction components optimally satisfy the demands of passengers and the requirements of railway operators.

Glass fibre GFK profiles offer many versatile solutions.

Jointly drawing from experience As a long-standing development, supply and logistics partner, Angst+Pfister maintains close contact with the development departments at Stadler Rail AG. Over this period of extensive cooperation, Angst+Pfister has accumulated a deep knowledge about the demands placed on modern railway vehicles within the industry. Angst+Pfister successfully incorporate its multifaceted rail industry experience in the development of the KISS double-decker train, the newest generation of Stadler Rail vehicles.

Demanding material requirements The windows of rail vehicles are subjected to extreme strains particularly at tunnel entrances and railway crossings approached at high speeds. The enormous forces generated by high velocity pressure must be absorbed and safely transmitted to the aluminum coach body. To this end it is necessary to interrupt the thermal bridges from outside to inside. The load-bearing profile must thus fulfill special material requirements: in addition to having high mechanical strength and good thermal insulation properties, it must keep expansion caused by temperature fluctuations to a minimum. The profile material must be designed in accordance with the geometric requirements (for double-deck coaches) and must also meet extensive fire safety requirements.

Pultrusion UP-GFK plastic profiles can offer many versatile solutions The complex requirement specifications were discussed in close cooperation between Stadler Rail's designers and Angst+Pfister's plastics specialists. Experience in developing the FLIRT and GTW vehicle generations and profound plastics technology expertise with regard to materials and process technology contributed to finding the optimum solution and implementing it successfully. The jointly developed product is based on pultruded UP-GFK profiles from Angst+Pfister. These are glass fiber-reinforced profiles with a matrix of unsaturated polyester resins.

Special challenge – groundbreaking achievement The innovative profile solution meets all of the mechanical and thermal requirements that were defined in advance. Moreover, this UP-GFK modification meets the strict fire safety requirements pursuant to CEN TS 45545-2 (2009) and DIN 5510-2 (2009). A special challenge was posed by the complex installation situation in the upper passenger deck, whose curved window geometry necessitated several profile forms. Angst+Pfister succeeded in pultruding a UP-GFK profile for the



Glass fibre-reinforced plastic profiles are manufactured through a pultrusion process



Upper deck with curved windows – their geometry poses special design requirements

vertical fastening element in the defined radius of the ceiling and window curvature – a groundbreaking achievement for this fabrication process.

Versatile deployment possibilities UP-GFK profiles are not just ideal for use in the KISS trains. The construction elements with their exceptional properties have virtually unlimited application possibilities. The high-quality Angst+Pfister profiles lend themselves as a solution, especially in cases where metals offer the desired mechanical strength but not the necessary corrosion resistance or electrical

and/or thermal insulation properties. Their low weight makes them suitable for lightweight construction, and they are exceptionally UV- and weather-resistant and are excellent for bonding. In addition to various standard profiles, customized geometries can be produced as well.

Angst+Pfister will be glad to advise customers on the versatile application possibilities for UP-GFK profiles. Our plastics experts are always open to new tasks and challenges. With constructive collaboration, even innovative new projects can be successfully completed with optimum results using customized plastics solutions.

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Advantages of glass fiber-reinforced plastics



Self-extinguishing & halogen-free



Low weight



Resistant to corrosion and chemicals



High cost-effectiveness



Linear stress-strain behavior



Fast and easy installation



Deployment temperature range of -100 °C to +180 °C



Electrically insulating



High strength



UV- and weather-resistant