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Glass fibre reinforced unsaturated polyester (GF-UP) and phenacrylic (GF-PHA) resin structural composites
Structure, fabrication and properties

DIN 18820 Part 1

Laminate aus textilglasverstärkten ungesättigten Polyester- und Phenacrylatharzen (GF-UP, GF-PHA) für tragende Bauteile; Aufbau, Herstellung und Eigenschaften

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

The DIN 18820 series of standards comprises the following Parts:

DIN 18820 Part 1 Glass fibre reinforced unsaturated polyester (GF-UP) and phenacrylic (GF-PHA) resin structural composites; structure, fabrication and properties

DIN 18820 Part 2 Glass fibre reinforced unsaturated polyester (GF-UP) and phenacrylic (GF-PHA) resin structural composites; characteristic values of standard composites

DIN 18820 Part 3 Glass fibre reinforced unsaturated polyester (GF-UP) and phenacrylic (GF-PHA) resin structural composites; protection of structural layer

DIN 18820 Part 4 Glass fibre reinforced unsaturated polyester (GF-UP) and phenacrylic (GF-PHA) resin structural composites; testing and inspection

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1 Scope and field of application

1.1 This standard covers glass fibre reinforced unsaturated polyester (UP) and phenacrylic (PHA) resin composites of not less than 3 mm in thickness, which are made into structural members for use in the construction industry. It does not apply to composites made from prepregs and moulding compounds.

This standard deals with the structure, fabrication and properties of such composites, the design of structural members not being covered in this standard.

The use of GF-UP or GF-PHA structural members requires proof of suitability (e.g. in the form of building inspectorate approval (agrément)[1]).

2 Concepts

2.1 Composites

Composites are materials which are built up in layers. Although the surface layers form an integral part of the composites, they are not considered as having a loadbearing function.

2.2 Textile glass

See DIN 61850 for concepts relating to textile glass products.

2.3 Resins

See DIN 16945 and DIN 16946 Part 2 for concepts relating to, and methods of testing unsaturated polyester resins (UP resins) and phenacrylic resins (PHA resins).

2.4 Hardeners and accelerators

Hardeners and accelerators are substances in liquid, paste or granular form which initiate, accelerate or delay curing reactions (cf. DIN 16945 for definitions).

2.5 Random fibre composites

Random fibre composites (M) are composites in which the textile glass component (mat or chopped roving) has no preferred orientation.

2.6 Mixed composites

Mixed composites (MW) are composites in which random fibre layers alternate with layers in which unidirectional woven glass fabric (W) is used.

2.7 Wound composites

Wound composites (FM or FMU) are composites in which there are layers of random fibres (M) or lays (U) between the wound layers of roving strands (F).

2.8 Additives

Additives are powders (of not more than 100 µm particle size), pastes or liquids which can affect certain properties of the composites. They include, for example, insoluble pigments, soluble colorants, flame retardants, fillers and thixotropic agents. Hardeners and accelerators as defined in subclause 2.4 are not classed as additives.

[1] Issued by the *Institut für Bautechnik* (Institute of Building Technology), Berlin.

2.9 Surface layers

The term 'surface layer' comprises gel coat, surfacing mat, synthetic layer and thermoplastic liner, and serves to protect the structural layer.

2.9.1 Gel coat

A gel coat (FS) is a thin layer of resin on the surface of composites.

2.9.2 Surfacing mat

A surfacing mat (VS) is a surface layer which has a high resin content and consists of bonded staple fibres. The mat may consist of textile glass or synthetic fibres as specified in DIN 60001 Part 3.

2.9.3 Synthetic layer

Synthetic layer (CSS) is a special random fibre layer which has a high resin content (cf. DIN 18820 Part 3).

2.9.4 Thermoplastic liner

Thermoplastic liner (THA) is a thermoplastic material in the form of tube or sheath resistant to agressive media and thus protecting the structural layer. It shall be bonded to the structural layer or be dimensionally stable in itself.

3 Components of structural layer

3.1 Resins

Only UP and PHA resins (cf. subclause 2.3) shall be used for the structural layer.

The resins given in table 1 can be used at temperatures up to 40 °C (e.g. in buildings or in the ground); at higher temperatures and in the open air, only resins with properties meeting the requirements specified in DIN 16946 Part 2 for types 1130, 1140, 1310 and 1330 may be used.

Resins shall be stored as described in clause 5 and used within the time limit specified by the manufacturer.

3.2 Reinforcing materials

Reinforcing materials shall consist of glass fibres with a filament diameter of not more than 29 µm in the form of rovings as specified in DIN 61855 Parts 1 and 2. Woven rovings conforming to DIN 61854 Parts 1 and 2 and continuous strand mats conforming to DIN 61853 Parts 1 and 2 shall have a filament diameter of not more than 22 µm, and chopped rovings conforming to DIN 61855 Parts 1 and 2, and chopped strand mats conforming to DIN 61853 Parts 1 and 2, shall have a filament diameter of not more than 19 µm.

The reinforcing materials shall be provided with the sizes and coupling agents required for finishing as specified in DIN 61853 Parts 1 and 2, DIN 61854 Parts 1 and 2 and DIN 61855 Parts 1 and 2. The fibre finish shall be stated on the packaging and the delivery note, and its composition shall not be altered from then on. The textile glass shall be conditioned prior to delivery so that, if subsequently stored as described in clause 5 and properly processed, the bond remains unchanged for a period to be specified by the manufacturer (this being a maximum of 6 months as from delivery).

3.3 Additives

3.3.1 Total content by mass

Additives (e.g. flame retardants) used in the structural layer shall constitute a total content by mass of not more than 5 % of the resin, subject to the requirements specified in subclauses 3.3.2 and 3.3.3 being satisfied.