

2. S&P FRP Strengthening Systems

The basic fibres used in S&P FRP composites are imbedded in a matrix of epoxy resin and are applied as reinforcements to an existing structural member. The fibres are supplied either as a fabric, known as **sheet form** or as a pre-cured laminate, known as a **laminate form**. When supplied in sheet form, the embedment into the epoxy matrix takes place on site by hand lamination. When supplied as pre-cured laminates, the laminates are adhered directly to the substrate.

S&P offers four types of fibre; carbon, e-glass, ar-glass and aramid. Each has its unique place in the field of structural strengthening, as is explained below.

S&P Sheets must be used in conjunction with approved epoxy resins. Likewise, S&P Laminates must be used in conjunction with approved epoxy adhesive pastes. S&P Systems can supply resins and adhesives, but users are able to source their own resin products, provided they meet with the prior approval of S&P Systems and have been rigorously tested for performance in conjunction with the appropriate S&P Fibre Product.

2.1 S&P Glass and Aramid Fibre Systems

These are supplied in sheet form only. In unidirectional S&P sheets, where the fibres lie mainly in a single direction, the fibres can be considered to be straight, although during hand lamination, they tend to become slightly wave-like in form. Reduction factors are used in designs to allow for irregularities in hand laminating techniques. In bi-directional S&P sheets, the fibres are woven and hence take on a pronounced wave-like form. Again, the appropriate reduction factor used in the design, takes care of this aspect.

2.1.1 S&P Glass Fibre Sheets (GFS) available are:

S&P G-Sheet E 50/50:	E-glass, E-modulus = 73,000 MPa, 175 gms/m ² of fibre in two orthogonal directions.
S&P G-Sheet E 90/10 A:	E-glass, E-modulus = 73,000 MPa, 400 gms/m ² of fibre in the main direction (10 % in the cross direction).
S&P G-Sheet E 90/10 B:	E-glass, E-modulus = 73,000 MPa, 800 gms/m ² of fibre in the main direction (10 % in the cross direction).
S&P G-Sheet AR 50/50:	AR-glass, E-modulus = 65,000 MPa, 175 gms/m ² of fibre in two orthogonal directions.
S&P G-Sheet AR 90/10 A:	AR-glass, E-modulus = 65,000 MPa, 400 gms/m ² of fibre in the main direction (10 % in the cross direction).
S&P G-Sheet AR 90/10 B:	AR-glass, E-modulus = 65,000 MPa, 800 gms/m ² of fibre in the main direction (10 % in the cross direction).

2.1.2 S&P Aramid Fibre Sheet (AFS) available is:

S&P A-Sheet 120 (290): Aramid, E-modulus 120,000 MPa, 290 gms/m² of fibre in a single direction.

2.2 S&P Carbon Fibre Systems

These exist in either **sheet** or pre-cured **laminated** form. Carbon fibres with high moduli of elasticity are used in the production. This modulus of elasticity is the decisive parameter when comparing the various types of carbon sheet and carbon laminate.

2.2.1 S&P Carbon Fibre Sheets (CFS) available are:

S&P C-Sheet 240 (200): E-modulus 240,000 MPa, 200 gms/m² of fibre in the main direction.

S&P C-Sheet 240 (300): E-modulus 240,000 MPa, 300 gms/m² of fibre in the main direction.

S&P C-Sheet 240 (400): E-modulus 240,000 MPa, 400 gms/m² of fibre in the main direction.

S&P C-Sheet 640 (400): E-modulus 640,000 MPa, 400 gms/m² of fibre in the main direction.



2.2.2 S&P Carbon Fibre Laminates (CFK) are available in two grades as follows:

S&P 200/2000, type 50/1.4:	E-modulus 205,000 MPa, 50mm x 1.4mm strip.
S&P 200/2000, type 60/1.4:	E-modulus 205,000 MPa, 60mm x 1.4mm strip.
S&P 200/2000, type 80/1.4:	E-modulus 205,000 MPa, 80mm x 1.4mm strip.
S&P 200/2000, type 90/1.4:	E-modulus 205,000 MPa, 90mm x 1.4mm strip.
S&P 200/2000, type 100/1.4:	E-modulus 205,000 MPa, 100mm x 1.4mm strip.
S&P 200/2000, type 120/1.4:	E-modulus 205,000 MPa, 120mm x 1.4mm strip.
S&P 150/2000, type 10/1.4:	E-modulus 165,000 MPa, 10mm x 1.4mm strip (cut-in laminate)
S&P 150/2000, type 20/1.4:	E-modulus 165,000 MPa, 20mm x 1.4mm strip (cut-in laminate)
S&P 150/2000, type 50/1.2:	E-modulus 165,000 MPa, 50mm x 1.2mm strip
S&P 150/2000, type 50/1.4:	E-modulus 165,000 MPa, 50mm x 1.4mm strip
S&P 150/2000, type 60/1.4:	E-modulus 165,000 MPa, 60mm x 1.4mm strip
S&P 150/2000, type 80/1.2:	E-modulus 165,000 MPa, 80mm x 1.2mm strip
S&P 150/2000, type 80/1.4:	E-modulus 165,000 MPa, 80mm x 1.4mm strip
S&P 150/2000, type 90/1.4:	E-modulus 165,000 MPa, 90mm x 1.4mm strip
S&P 150/2000, type 100/1.2:	E-modulus 165,000 MPa, 100mm x 1.2mm strip
S&P 150/2000, type 100/1.4:	E-modulus 165,000 MPa, 100mm x 1.4mm strip
S&P 150/2000, type 120/1.2:	E-modulus 165,000 MPa, 120mm x 1.2mm strip
S&P 150/2000, type 120/1.4:	E-modulus 165,000 MPa, 120mm x 1.4mm strip

Special width and thickness on demand.

S&P supplies FRP sheet and laminates in rolls. In special cases, part rolls can be supplied, but this adds to the unit cost.