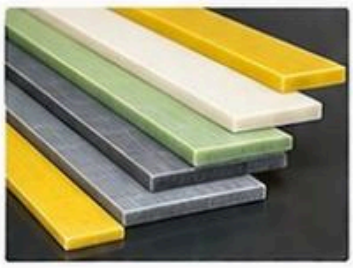
TECHNICAL DATA SHEET
Product Data · Design Formulas · Applications

FRP Flat Bar

PULTRUDED GFRP FLAT STRIP





Thickness & Width



Specifications



Colors & Finish



Applications

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NABAK COMPOSITE FRP flat bar (FRP / GRP Flat Bar) is a solid pultruded GFRP profile with a rectangular section. Strong in tension, lightweight, rust-free, electrically insulating and maintenance-free (no painting), it replaces steel, galvanized, aluminium and timber flat bar for toe boards, gusset plates, wear strips, cable-tray supports and insulating parts in corrosive and electrical environments.

25 – 200 mm	3 – 12.7 mm	≥ 240 MPa	≈ 1/4
Bar width	Bar thickness	Longitudinal tensile strength	of the weight of an equal steel flat bar

What is FRP flat bar (GFRP strip)?

Composite flat bar, also known as **FRP flat bar**, **GFRP strip**, **fiberglass flat bar**, **composite strip profile** and **narrow composite plate**, is made by continuously pulling glass-fibre rovings and surface mats impregnated with resin through a heated rectangular die. Flat bar usually has a higher share of longitudinal fibre than other profiles, so it performs very well in tension and bending along its length and is ideal for tension members and plate parts.

FRP is the general name for fibre-reinforced polymers, and GFRP (or GRP) is FRP made with glass fibre. Flat bar is a simple section with one strong axis (on edge) and one very weak axis (flat); this difference is critical in the design of FRP flat bar and is explained on pages 4 and 5.

Structure of composite flat bar

Longitudinal roving core	Transverse mat	Surface veil	Edges
Continuous, parallel glass fibres; the main source of tensile strength and stiffness of FRP flat bar.	Continuous mat or fabric that raises transverse strength, bolt bearing and resistance to splitting.	Smooth, resin-rich surface with UV additives for durability and a uniform finish.	Sharp or rounded edges (to order); rounded edges for toe boards and hand-accessible parts.

Advantages of FRP flat bar over steel flat bar

- **Corrosion-resistant:** composite flat bar does not rust in seawater, chlorine, acids or chemical fumes.
- **Electrically and thermally insulating:** GFRP strip suits insulating parts of panels, substations and busbar supports.
- **Lightweight:** a 100×10 fiberglass flat bar weighs only 1.85 kg/m — about a quarter of steel.
- **High tensile strength:** equal to or higher than structural steel along the length.
- **Non-magnetic and non-sparking:** suited to explosive atmospheres and sensitive equipment.
- **Easy fabrication:** cut and drilled with simple tools; no welding or hot work.

Applications of FRP flat bar

Handrail toe boards	Gusset and splice plates	Wear strips and guides
100 or 150 mm toe boards for FRP handrails on platforms and walkways	Gusset plates and splices for composite beams, columns and bracing	Conveyor wear strips, chain guides and sliding-door guides
Cable tray and electrical	**Cooling towers**	**Edging and fencing**
Supports, clamps and insulating parts of panels and substations	Blades, fill supports and internals resistant to humidity	Edging, frames, fences and light corrosion-free railings

Size and section property table of composite flat bar

Table 1 — FRP flat bar: sizes, weight and section properties (ρ = 1.85 g/cm³)

Width × thickness b×t (mm)	A (mm²)	Weight (kg/m)	I strong (on edge) (mm⁴)	W strong (mm³)	I weak (flat) (mm⁴)	W weak (mm³)	J (mm⁴)	Ultimate tensile force (kN)
25 × 3	75	0.14	3.91×10^{3}	312	56	38	208	18.0
25 × 6.4	160	0.30	8.33×10^{3}	667	546	171	1.83×10^{3}	38.4
38 × 6.4	243	0.45	2.93×10^{4}	1.54×10^{3}	830	259	2.97×10^{3}	58.4
50 × 5	250	0.46	5.21×10^{4}	2.08×10^{3}	521	208	1.95×10^{3}	60.0
50 × 6.4	320	0.59	6.67×10^{4}	2.67×10^{3}	1.09×10^{3}	341	4.02×10^{3}	76.8
50 × 10	500	0.93	1.04×10^{5}	4.17×10^{3}	4.17×10^{3}	833	1.46×10^{4}	120
76 × 6.4	486	0.90	2.34×10^{5}	6.16×10^{3}	1.66×10^{3}	519	6.29×10^{3}	117
76 × 9.5	722	1.34	3.48×10^{5}	9.15×10^{3}	5.43×10^{3}	1.14×10^{3}	2.00×10^{4}	173
100 × 6.4	640	1.18	5.33×10^{5}	1.07×10^{4}	2.18×10^{3}	683	8.39×10^{3}	154
100 × 10	1000	1.85	8.33×10^{5}	1.67×10^{4}	8.33×10^{3}	1.67×10^{3}	3.12×10^{4}	240
150 × 10	1500	2.78	2.81×10^{6}	3.75×10^{4}	1.25×10^{4}	2.50×10^{3}	4.79×10^{4}	360
200 × 12.7	2540	4.70	8.47×10^{6}	8.47×10^{4}	3.41×10^{4}	5.38×10^{3}	1.31×10^{5}	610

Ultimate tensile force is calculated with the minimum strength of 240 MPa (grade E23); allowable working load = ultimate force ÷ safety factor (2.5 to 3), always checked for holes and connections (Formulas 9 and 10). Section properties from Formulas 1 to 4 (page 4).

Supply form, tolerances and colours of FRP flat bar

Table 2 — Supply specifications of composite flat bar

Parameter	Value	Remarks
Common widths	25, 38, 50, 76, 100, 150, 200 mm	Other widths by new die or slitting
Common thicknesses	3, 5, 6.4, 9.5, 10, 12.7 mm	Imperial and metric thicknesses
Bar length	6 m (up to 12 m)	Cutting and drilling to drawing
Width / thickness tolerance	±0.5 mm / ±0.3 mm	Per EN 13706-2
Colour	Yellow, grey, green, cream, black	Pigment through the thickness; custom RAL
Surface	Smooth, matt, grit anti-slip	Anti-slip surface for stairs and platform edges
Resin	Isophthalic / vinyl ester / fire-retardant	Vinyl ester for chemical environments; fire-retardant ASTM E84 ≤ 25

Selection guide for composite flat bar

Table 3 — Recommended FRP flat bar for common applications

Application	Recommended bar (mm)	Note
Composite handrail toe board	100 × 6.4 / 150 × 10	Bracket connection at each post; rounded edge
Gusset and splice plates for profiles	76 × 9.5 / 100 × 10 / 150 × 10	Check bolt bearing (Formula 9)
Wear strips and guides	25 × 6.4 / 50 × 6.4	Countersunk screws or adhesive on a continuous base
Cable-tray clamps and supports	38 × 6.4 / 50 × 5	Insulating and corrosion-free in electrical installations
Insulating parts of panels and busbars	50 × 10 / 76 × 9.5	Electrical-grade resin; adequate creepage distance
Cooling-tower blades and supports	50 × 5 / 76 × 6.4	Vinyl ester resin in hot and chlorinated water
Tension restraints and ties	50 × 10 / 100 × 10	Net-section and connection capacity (Formulas 8 to 11)

Mechanical and physical properties of composite flat bar

Table 4 — Reference properties of pultruded GFRP flat bar

Property	Test method	EN 13706 grade E23 minimum	Typical value, FRP flat bar
Longitudinal tensile strength	EN ISO 527-4	240 MPa	280 – 450 MPa
Longitudinal tensile modulus	EN ISO 527-4	23 GPa	23 – 32 GPa
Transverse tensile strength	EN ISO 527-4	50 MPa	50 – 70 MPa
Longitudinal flexural strength	EN ISO 14125	240 MPa	300 – 450 MPa
Longitudinal compressive strength	EN ISO 14126	–	240 – 350 MPa
Shear modulus G	–	–	3 – 4 GPa
Apparent shear strength	EN ISO 14130	25 MPa	25 – 40 MPa
Pin-bearing strength, longitudinal / transverse	EN 13706	150 / 70 MPa	180 – 220 / 90 – 120 MPa
Density	ISO 1183	–	1.8 – 2.0 g/cm³
Longitudinal coefficient of thermal expansion	–	–	6 – 10 ×10^{-6} /°C
Dielectric strength (perpendicular to face)	ASTM D149	–	5 – 10 kV/mm

Values are typical ranges of the FRP and GFRP composites industry and of EN 13706-3, and are not NABAK COMPOSITE's own laboratory results.

Composite flat bar compared with metal and plastic flat bar

Table 5 — FRP flat bar 100×10 vs steel, aluminium and polyethylene flat bar

Feature	GFRP flat bar	Steel flat bar	Aluminium flat bar	UHMW-PE strip
Weight (kg/m)	1.85	7.85	2.7	0.94
Tensile strength (MPa)	240 – 450	360 – 510 (ultimate)	200 – 300	20 – 40
Modulus (GPa)	23 – 32	210	70	0.7 – 1
Corrosion	None	Severe	Moderate	None
Electrically insulating	Yes	No	No	Yes
Dimensional stability and creep	Excellent	Excellent	Excellent	High creep

GFRP flat bar or CFRP laminate? In the market, "FRP strip" sometimes refers to carbon laminates (CFRP) for strengthening concrete beams and slabs. CFRP laminate has a modulus of 160 to 200 GPa and is designed for structural strengthening. NABAK flat bar is GFRP, intended for lightweight, corrosion-free and insulating structural parts; for concrete strengthening projects, design by a structural engineer and selection of the laminate type are essential.

Selecting flat bar resin by environment

Table 6 — Recommended resin for GFRP flat bar

Service environment	Recommended resin	Approx. service temperature
Indoor, general industrial, electrical	Isophthalic polyester	Up to ≈ 80 °C
Acids, alkalis, chlorine, seawater	Vinyl ester	Up to ≈ 100 °C
Public spaces, tunnels, fire requirements	Fire-retardant resin (ASTM E84 ≤ 25)	Up to ≈ 80 °C
Outdoors with strong sunlight	Any resin + UV veil or polyurethane coating	–

Section formulas for composite flat bar

1. Cross-section area and weight

$$A = b \cdot t\,, \quad w = \rho \cdot A$$

100×10: A = 1000 mm²; w = 1.85 × 1000 × 10⁻³ = 1.85 kg/m

2. Moment of inertia and section modulus, strong axis (on edge)

$$I_s = \frac{t\,b^3}{12}\,, \quad W_s = \frac{t\,b^2}{6}$$

100×6.4: $I_s \approx 5.33\times10^5$ mm⁴, $W_s \approx 1.07\times10^4$ mm³

3. Moment of inertia and section modulus, weak axis (flat)

$$I_w = \frac{b\,t^3}{12}\,, \quad W_w = \frac{b\,t^2}{6}$$

100×6.4: $I_w \approx 2.18\times10^3$ mm⁴; about 240 times smaller than the strong axis

4. Torsion constant of a thin rectangle

$$J \approx \frac{b\,t^3}{3}\left(1 - 0.63\,\frac{t}{b}\right)$$

100×6.4: J ≈ 8 738 × 0.96 ≈ 8.39×10^3 mm⁴

Composite flat bar as a beam

5. Lateral-torsional buckling of a bar on edge

$$M_{cr} = \frac{\pi}{L_b}\sqrt{(E\,I_w \cdot G\,J)}\,, \quad M_y = \sigma_u \cdot W_s$$

Example — FRP flat bar 100×6.4 on edge, E = 23 GPa, G = 3 GPa:

$M_y = 240 \times 1.07\times10^4 \approx 2.56$ kN·m (cross-section strength)

$L_b = 0.5$ m: $M_{cr} \approx 0.22$ kN·m ; $L_b = 1.0$ m: $M_{cr} \approx 0.11$ kN·m

Without lateral restraint, a composite flat bar on edge reaches only 4 to 9 percent of its section bending strength and twists quickly. Do not use FRP flat bar as a free beam; for bending choose a composite angle, channel or tube, or a flat bar with continuous restraint (bolted to a post or flange).

6. Compression buckling of flat bar (weak axis)

$$P_{cr} = \frac{\pi^2\,E\,I_w}{(K\,L)^2}$$

50×10, 600 mm long, pinned both ends: $P_{cr} = \pi^2 \times 23\,000 \times 4167 / 600^2 \approx 2.6$ kN, against a tensile capacity of 120 kN. FRP flat bar is not suitable in compression.

7. Flat bending of the bar (wear strip, toe board)

$$\sigma = \frac{M}{W_w}\,, \quad \delta = \frac{P\,L^3}{48\,E\,I_w}$$

150×10 toe board between posts 1.5 m apart under 222 N (OSHA): σ = (222 × 1500/4) / 2500 ≈ 33 MPa ≤ 96 ✓; deflection is relatively large and connecting the toe board to an intermediate post reduces it.

Design rule for composite flat bar: FRP flat bar performs best in **tension** and as a **plate** (gusset, splice, strip, cover). In compression, free bending on edge and torsion, the thin rectangular section is very weak and should be restrained continuously or replaced by a more suitable profile.

Composite flat bar in tension and connections

8. Net-section tensile capacity

$$A_n = (b - n \cdot d_h) \cdot t \,, \quad T_a = \frac{\sigma_t \cdot A_n}{FS}$$

n number of holes in one cross-section, d_h hole diameter. Bar 76×9.5 with one 13 mm hole: A_n = 63 × 9.5 ≈ 599 mm² → T_a = 240 × 599 / 2.5 ≈ 57.5 kN

9. Bolt bearing capacity

$$P_{br} = \frac{n \cdot d \cdot t \cdot \sigma_{br}}{FS}$$

2 M12 bolts in a 9.5 mm bar, σ_{br} = 150 MPa, FS = 3: P_{br} ≈ 11.4 kN. In FRP flat bar connections, bolt bearing is about one fifth of the section capacity; more bolts or structural adhesive are needed to use the bar's tensile capacity.

10. Minimum bolt distances in flat bar

$$e_1 \geq 2d \,, \quad e_2 \geq 1.5d \,, \quad p \geq 4d \,, \quad b \geq 3d$$

M12 bolt: end distance ≥ 24, edge distance ≥ 18 and pitch ≥ 48 mm; minimum bar width for one row of M12 about 36 mm

11. Bonded lap joint (splice)

$$P_a = \frac{\tau_a \cdot b \cdot l_o \cdot k_e}{FS}$$

τ_a ≈ 10 MPa (structural epoxy), k_e ≈ 0.5 stress-concentration factor. 76 mm bar with 100 mm overlap and FS = 3: P_a ≈ 12.7 kN; combining adhesive and bolts gives a stronger joint.

12. Minimum elastic bending radius

$$R_{min} = \frac{E \cdot t}{2\,\sigma_a}$$

σ_a ≈ 0.3 σ_u = 72 MPa for permanent bending. 6.4 mm bar: R_{min} ≈ 23 000 × 6.4 / 144 ≈ 1.0 m; suitable for curved edging and curved blades

Fabrication guide for composite flat bar

1. **Cutting:** cut FRP flat bar with a diamond or carbide saw blade at low feed pressure so the edge does not delaminate.
2. **Drilling:** use a carbide drill, hole diameter 1 mm larger than the bolt, with a timber backing to prevent breakout at the back of the hole.
3. **Sealing:** coat cut edges and holes with compatible resin.
4. **Connection:** stainless or FRP bolts with wide washers on both sides; controlled torque.
5. **Load direction:** keep tensile load along the length of the bar; limit flat bending and torsion.
6. **Safety:** wear a mask, goggles and gloves when cutting; collect fibre dust with extraction.

Is composite flat bar electrically conductive?

No. GFRP flat bar is an electrical insulator. For high-voltage parts, surface creepage distance and surface contamination must also be considered in design.

Are custom widths and thicknesses of FRP flat bar possible?

Yes. Custom sizes of composite flat bar are produced with a new pultrusion die or by slitting from wide sheet and bar.

Request a quote for FRP flat bar: send width and thickness, length and number of bars, colour, surface, resin type and the cutting and drilling drawing.

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Disclaimer: The information in this data sheet is based on general, typical data of the FRP and GFRP composites industry and the EN 13706 standard, and is intended as guidance only. Examples are for illustration; structural design must be carried out by a qualified engineer. NABAK COMPOSITE reserves the right to change technical specifications without notice.