



TECHNICAL MANUAL · OCTOBER 2026 EDITION

FRP Profile Design Manual

Pultruded structural profiles · EN 13706 grade E23



I-BEAM



CHANNEL



ANGLE



SQUARE TUBE



RECTANGULAR TUBE



ROUND TUBE



ROD



FLAT BAR

114

catalog sizes

8

section families

23 GPa

E23 longitudinal modulus

6 m

standard length

About this edition

Revision B replaces the April 2026 edition (Rev. A), which was withdrawn in September 2026 because it described a laminate, a service life and fire and chemical data that F1 Composite does not publish. This edition is generated from the same data that the website, the per-size datasheets and the engineering tools use, so a value here is the value you will find there.

What changed from Rev. A

- The standard laminate is the **isophthalic polyester E23 laminate** printed on every F1 datasheet. Rev. A described an epoxy laminate as standard; epoxy is a project option.
- Section tables cover **all 114 catalog sizes** with the published mass and section properties computed from the nominal section, in place of five section types (about fifteen imperial sizes) whose properties could not be reproduced.
- Load tables follow the **published design basis** (LRFD to ASCE/SEI 74–23 factors, L/250, shear deflection included) and give allowable loads, not unfactored deflections at L/200.
- Fire and chemical performance are stated **by resin formulation with their evidence status**. The UK fire-classification table (which included an aluminum deck and cladding row and platform-system rows) and the unattributed chemical table were removed.
- No design-life, warranty or maintenance-interval promise is made; durability depends on the

formulation, the exposure and the inspection plan (Section 7).

- Standard citations were corrected: interlaminar shear is EN ISO 14130 (Rev. A printed a truncated standard number) and the grade minimums are cited to EN 13706–3 Table 1; the pin-bearing method is EN 13706–2 Annex E, as the datasheets now also state.

How values are labeled

Label	Meaning
PUBLISHED	An F1 catalog value: the mass per meter of every size, and the laminate values F1 publishes above the grade minimum.
EN MINIMUM	The requirement of EN 13706–3:2002 Table 1 for the declared grade. A laminate declared to E23 meets or exceeds it.
TYPICAL	An industry value for the resin system that EN 13706 does not specify, pending F1 certified test data.
REFERENCE	An attributed published value (a standard, an industry association or a supplier chart). It is not an F1 test result.
CALCULATED	Derived from the nominal, sharp-cornered section or from the stated formulas and factors.
TEST REPORT	A result from a named third-party report, quoted with its scope. It applies to the tested specimen.

Using this manual

The tables are a preliminary-sizing aid for engineers who know steel or aluminum and are specifying pultruded FRP for the first or second time. They compare candidate sections, reproduce assumptions and prepare a request for quotation. A qualified engineer establishes the governing loads, combinations, restraint, code edition, material qualification, connection details and final limit states for the actual project. Confirm the certificate holder, product or specimen, report number, method, date and scope. EN 13706 and ASTM D3917 are specification references, not proof of blanket certification. CE/UKCA documentation depends on the product, intended use and applicable assessment route.

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Figures and tables

- Section 2: laminate build-up (Fig. 1), E23 laminate with EN minimums, SGS full-section reports, resin systems, reference values.
- Section 3: codes by market, resistance factors, λ and environment factors, material inputs, load cases, worked beam and column examples, connections, thermal movement.
- Section 4: dimensioned section drawings (Figs. 2 to 9) and properties of all 114 sizes.
- Section 5: allowable uniform loads for 65 sections over 8 spans.

- Section 6: selection matrix, 7 application guides, handrail and ladder catalog data, access rules.

Finding a value on the website

Every size in Section 4 has a datasheet page with the same properties, a DXF and the laminate data; every row of Section 5 opens pre-loaded in the profile calculator; every report in Section 9 is downloadable from the evidence page. Where the website and this PDF differ, the website carries the later revision.

01

F1 Composite and the F1-STRUX range

F1 Composite is the export company of FengDu New Material. This manual covers the F1-STRUX standard pultruded profile range: 114 catalog sizes in 8 section families, declared to EN 13706 grade E23, with the design basis, section data, allowable-load tables and application guidance needed to specify them.

The company

F1 Composite (Chongqing F1 Composites Co., Ltd.) is the export company of FengDu New Material. FengDu is the parent company of Chongqing Xianju New Material Co., Ltd. and runs the production network; F1 handles international sales, engineering support, documentation and delivery.

The group's production network has 5 manufacturing bases and 370 pultrusion lines with about 150,000 metric tons of annual capacity and 1,000 die sets, in Chongqing, China and Yancheng, Jiangsu, China. F1 Composite was founded in 2015 and supplies 30+

countries. Chongqing Xianju New Material Co., Ltd. is the FengDu subsidiary named on several product documents, including the SGS full-section reports in Section 2.

The "F1" stands for "Fiber One". F1 Composite is an industrial FRP company with no connection to motorsport.

Certificates and evidence

ISO 9001, CE, fire-test and other certificates are provided on request, with the certificate holder, number and scope. Published test reports are listed on the evidence page.

Product lines

Product line	Products	Scope
F1-STRUX	Standard Pultruded Profiles	Choose an established fiberglass section and review dimensions, properties and weight per meter. Standard sections are also known as FRP structural shapes or GRP profiles.
F1-FORM	Custom Pultruded Profiles	Develop a cross-section around your drawing, material requirements and production volume. Review tooling, samples and secondary fabrication before production.
F1-THERM	Windows & Doors	Pultruded window and door profiles for fabricators, reinforcement sections, and finished fiberglass windows and doors for building projects.
F1-GRID	FRP Grating	Compare molded and pultruded fiberglass grating by construction, panel layout, span direction, surface and resin requirements.
F1 Composite	FRP Rebar	GFRP straight bars, factory-formed stirrups and reinforcement mesh for concrete. Review application requirements, prepare a bar schedule and confirm grade-specific documents.
F1 Composite	Fasteners & Fittings	Fiberglass threaded rods, nuts, washers and molded connection fittings. Match the thread, resin and complete joint before ordering.

5

production bases

370

pultrusion lines

150k t

annual capacity

1,000

die sets

30+

export markets

Supply terms and what the catalog is

Catalog sizes are standard section options, not stock.

Catalog dimensions identify standard section options, not live inventory. Confirm tooling, material, quantity and production timing in the quotation. Pricing is confirmed against the section or assembly, resin, quantity, tooling, finishing, packing, destination and Incoterm. Calculator estimates are planning references, not offers.

Item	F1 term
Reply to an inquiry	Within one business day
Catalog section, existing die	2–4 weeks
Variant on an existing die	4–6 weeks
New section, new die	6–10 weeks (die manufacture 4–8 weeks)
Minimum run, custom section	500 m first run; 200 m repeat
One-time die cost	USD 5,000–8,000 small single-cavity; USD 15,000–40,000 large or multi-cavity
Standard length	6 m; cut to length on request

Stock lengths and containers

Length	Note
5.8 m	Fits a 20 ft container (inside length about 5.90 m).
6 m	F1 standard length. Longer than a 20 ft container, so it ships in a 40 ft container.
11.8 m	Usual export length for a 40 ft container.
12 m	Leaves about 30 mm in a 40 ft container (inside length about 12.03 m).

Colors, surface and tolerances

Standard colors are gray and safety yellow; custom RAL colors are available for orders that meet the minimum quantity, typically 200 linear meters. Standard profiles are pultruded with a surface veil that forms a resin-rich outer layer; UV-stabilized resin and a compatible coating can be specified for exposed service (Section 7).

Identify the applicable tolerance standard, edition and class on the approved drawing: ASTM D3917, EN 13706–2 or GB/T 31539 where applicable. Agree the size band, datums, wall and corner limits, straightness over a stated gauge length, twist and cut length (Section 9). Raw-profile tolerances and finished machining tolerances are separate; no universal flat-bar or cut-length tolerance is promised.

Resin is chosen per production run. The same die runs isophthalic polyester, fire-retardant polyester, vinyl ester, polyurethane, epoxy or phenolic; the resin system becomes part of the quoted specification and is recorded on the mill certificate. State chemicals, temperature, fire code and UV exposure in the inquiry.

Standards the range is specified against

Topic	Europe	North America	China
Profile grade and test methods	EN 13706-1/-2/-3 (grades E17, E23)	ASTM D7290 characteristic values; ASTM D638, D790, D695, D2344 coupon methods	GB/T 31539-2015
Dimensional tolerances	EN 13706-2	ASTM D3917-23	GB/T 31539
Structural design	CEN/TS 19101:2022 with EN 1990/1991 actions	ASCE/SEI 74-23 with ASCE 7-22 loads	GB 50608-2020; T/CECS 692-2020
Workplace access	EN ISO 14122 series	OSHA 29 CFR 1910 Subpart D; IBC 2024	GB 4053
Reaction to fire	EN 13501-1; EN 45545-2 (rail)	ASTM E84; UL 94 (plastic parts)	GB 8624-2012 (2025 edition from 1 January 2027)

The catalog at a glance

8 families · 114 sizes · 0.05 to 16.8 kg/m



I-beams and wide flanges

9 SIZES · 76×38 TO 305×305 MM

Primary beams for walkways, platforms and bridges; the most bending stiffness per kilogram.

1.2–16 KG/M



Channels

19 SIZES · 38×13 TO 360×108 MM

Secondary framing, cable-tray stringers, stair stringers and modular skids; open section for bolted connections.

0.4–15 KG/M



Angles

15 SIZES · 25×25 TO 152×152 MM

Stiffeners, bracing, ledgers, cleats and corner connections.

0.3–6 KG/M



Square tubes (SHS)

15 SIZES · 25×25 TO 240×240 MM

Columns, posts, trusses and frames; closed section with high torsional stiffness.

0.4–16.8 KG/M



Rectangular tubes (RHS)

5 SIZES · 40×20 TO 120×60 MM

Purlins, crossarms and frame rails where one axis carries more load.

1–3.6 KG/M



Round tubes (CHS)

17 SIZES · Ø25 TO Ø150 MM

Handrails, guardrail posts, masts, conduits and insulating stand-offs.

0.3–5.4 KG/M



Solid rods

16 SIZES · Ø6 TO Ø50 MM

Tie rods, spacers, insulators and stakes; unidirectional rovings.

0.05–3.57 KG/M



Flat bars

18 SIZES · 12×3 TO 305×25 MM

Stiffeners, splice plates, kick plates, wear strips and spacers.

0.07–13.86 KG/M

Beyond the catalog

A section the catalog does not cover is developed from your drawing on new tooling (F1-FORM): cross-sections up to about 600 × 300 mm, multi-cell hollows, dog-bone and strut profiles, and sections with integrated screw channels. Tooling, sampling and secondary fabrication are reviewed before production; the minimum runs and die costs on the previous page apply.

Handrail and fixed-ladder systems assembled from square and round tube, angles and flat bars of the handrail and ladder catalogs (some wall thicknesses differ from the Section 4 profile sizes) are described in Section 6, with the catalog dimensions and the load cases they are checked against. Grating, stair treads, GFRP rebar, window profiles and fasteners have their own catalogs on the website.

How a catalog designation reads

Prefix	Family	Designation	Dimensions in order
I	I-beams and wide flanges	I 200×100×10	depth H × flange width B × thickness t (flange and web)
U	Channels	U 200×60×8	depth H × flange width B × thickness t
L	Angles	L 100×100×10	leg a × leg b × thickness t
SHS / RHS	Square and rectangular tubes	SHS 100×100×8, RHS 120×60×5	outside depth × outside width × wall t
CHS	Round tubes	CHS 100×6	outside diameter × wall t
Rod	Solid rods	Rod Ø25	diameter
FB	Flat bars	FB 100×10	width × thickness

The datasheet of a size is at www.f1composite.com/datasheets/<designation>, with the designation written in lower case and "x" between the numbers (i-200x100x10, chs-100x6, rod-25, fb-100x10).

02

Material: the E23 laminate and resin systems

A pultruded profile is a stack of continuous glass reinforcement in a thermoset matrix. The glass sets stiffness and strength along the profile; the resin sets what happens off-axis and over time: chemical and fire behavior, temperature limit, transverse strength and durability. This section gives the laminate values F1 publishes, the EN 13706 grade minimums beside them, and the resin systems the same dies run.

Fiber architecture

Unidirectional rovings in the core carry axial tension, compression and bending; they give the longitudinal modulus of 23 GPa. **Continuous filament mat** layers add transverse strength and hold the rovings together under shear; without them the transverse modulus would fall well below the 7 GPa grade minimum. A **surface veil** forms a resin-rich skin that protects the glass from UV, moisture and chemicals and gives the finish. Glass content is 65–70% by weight and density 1.9 g/cm³ for the standard laminate.

Why direction matters

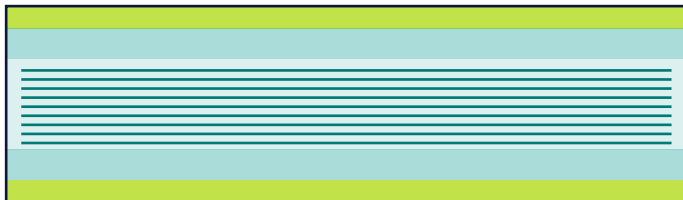
Longitudinal properties are two to five times the transverse ones (tensile strength 240 against 50 MPa at

the E23 minimum). Member checks use the longitudinal values; connections, bearing at bolts, web crippling and local buckling depend on the transverse and shear values. Every table in this manual states the direction.

Matrix role

The cured resin, about 30 to 35 percent of the standard laminate by weight and roughly half by volume, binds the fibers, transfers load between them in shear, stops fiber micro-buckling in compression and forms the barrier to the environment. Two profiles with identical E23 stiffness can have very different service lives if one has the wrong matrix for the exposure (Section 7).

FIG. 1 Laminate build-up of a pultruded flange or wall



Schematic, not to scale. Layer count and mat weight vary by section and wall thickness.

Surface veil: resin-rich skin, UV and chemical barrier
Continuous filament mat: transverse strength and shear

Unidirectional rovings: axial stiffness and strength

Continuous filament mat
Surface veil

The standard E23 laminate

E-glass / isophthalic polyester, EN 13706 grade E23

The values printed on every F1 product datasheet, with the EN 13706–3:2002 Table 1 minimums for grades E23 and E17 beside them. Read them as material characterization: member capacity comes from these values combined with section properties, factors, connections and the project code (Section 3).

Property	Published E23 laminate	EN 13706 E23 minimum	EN 13706 E17 minimum	Test method
Tensile modulus (longitudinal)	23 GPa EN MINIMUM	23 GPa	17 GPa	EN ISO 527–4
Tensile modulus (transverse)	7 GPa EN MINIMUM	7 GPa	5 GPa	EN ISO 527–4
Tensile strength (longitudinal)	240 MPa EN MINIMUM	240 MPa	170 MPa	EN ISO 527–4
Tensile strength (transverse)	50 MPa EN MINIMUM	50 MPa	30 MPa	EN ISO 527–4
Flexural strength (longitudinal)	240 MPa EN MINIMUM	240 MPa	170 MPa	EN ISO 14125
Flexural strength (transverse)	100 MPa EN MINIMUM	100 MPa	70 MPa	EN ISO 14125
Interlaminar shear strength (ILSS)	30 MPa PUBLISHED	25 MPa	15 MPa	EN ISO 14130
Pin-bearing strength (longitudinal)	150 MPa EN MINIMUM	150 MPa	90 MPa	EN 13706–2 Annex E
Pin-bearing strength (transverse)	70 MPa EN MINIMUM	70 MPa	50 MPa	EN 13706–2 Annex E
Compressive strength (longitudinal)	240 MPa TYPICAL	Not specified	Not specified	EN ISO 604
Barcol hardness	45 TYPICAL	Not specified	Not specified	ASTM D2583
Water absorption (24 h)	0.6 % TYPICAL	Not specified	Not specified	EN ISO 62
Density	1.9 g/cm ³ PUBLISHED	Not specified	Not specified	EN ISO 1183
Glass content	65–70% by weight PUBLISHED	Not specified	Not specified	EN ISO 1172
Full-section flexural modulus (grade test)	≥ 23 GPa EN MINIMUM	23 GPa	17 GPa	EN 13706–2 Annex D, full section

Reading the table. Interlaminar shear strength is published at 30 MPa, above the EN 13706 minimum of 25 MPa. The moduli, tensile, flexural and pin-bearing strengths are published at the E23 minimums, which is what a laminate declared to the grade guarantees; batch values are higher and are reported on request. Transverse values are much lower than longitudinal, so connections need their own check.

Compressive strength, Barcol hardness and water absorption are not specified by EN 13706 — the figures

shown are typical industry values for this resin system, pending F1 certified test data; request certified values before final design. The ILSS value is an apparent interlaminar shear strength from the short-beam method (EN ISO 14130); it is not an in-plane shear strength. The design tools and the span tables of Section 5 take the EN minimum of 25 MPa, not the published 30 MPa, as the shear strength, because EN 13706 gives no in-plane value and the minimum is what every batch guarantees.

E23 establishes stiffness and strength, nothing else. Fire behavior, electrical insulation and resistance to a particular chemical need their own evidence for the supplied formulation and configuration. EN 13706 and ASTM D3917 are specification references, not proof of blanket certification.

Grades, higher-modulus tiers and the SGS full-section reports

E17 and E23

EN 13706–3 defines two structural grades, named for the minimum full-section flexural modulus in GPa. E23 is the F1 standard for load-bearing members; E17 (glass content 55–60% by weight, density 1.8 g/cm³, both **TYPICAL**) is offered for secondary and lightly loaded members where cost matters more than stiffness. The E17 minimums are in the table on the previous page.

Higher-modulus laminates

Above E23 the names are commercial, not EN grades. **E30** is a vendor tier defined by a full-section modulus of at least 30 GPa. **"E40"** is a bridge-grade threshold used by Austroads ATS 5880 (full-section modulus of at least 40 GPa); its benchmark construction, as published for an Australian pultruder's bridge product (industry reference, not F1 data), is a fire-retardant vinyl ester laminate with about 77 percent glass by weight. For both tiers only the

defining modulus is set; every strength requires program test data before release, and the bridge specification a project adopts may additionally call for characteristic values to ASTM D7290 and a full-section bending test (for example ASTM D6109 or EN 13706–2 Annex D).

What the SGS reports show

Two SGS full-section tests to EN 13706–2 Annex D on square tubes, issued 2026–09–07 to Chongqing Xianju New Material Co., Ltd., gave averages of 40.8 and 41.5 GPa. They support a 40 GPa-class laminate for the tested samples. They are not EN 13706 certification, not a design allowable and not size-specific qualification: the specification code on page 1 of each report and the specimen size on page 3 do not match, and the laboratory's clarification is needed before a result is assigned to a catalog size. Both originals are published on the website evidence page.

Report	Page 1 specification	Specimen (page 3)	Span	Rate	Individual results (GPa)	Average
SGS SHIN2608002943CM01_EN	60605	2160 × 90 × 90 mm	1,800 mm	9 mm/min	41.2 / 41.1 / 40.1	40.8 TEST REPORT
SGS SHIN2608002943CM02_EN	90905	1440 × 60 × 60 mm	1,200 mm	6 mm/min	41.1 / 42.1 / 41.3	41.5 TEST REPORT

Each report limits its results to the tested samples and carries an internal-reference use note. Quote them as "SGS full-section test, EN 13706–2 Annex D, 40.8 / 41.5 GPa average of three specimens", never as "E40 certified".

Resin systems

Declared to EN 13706 grade E23 (UP–E17 to grade E17); the resin sets chemical and fire behavior, not stiffness

Code	Matrix	Glass (by weight)	Density	Fire behavior of the formulation	Where it is used
E23-ISO	Isophthalic unsaturated polyester	65–70% by weight	1.9 g/cm³	Standard grade — not fire-retardant (specify an FR grade for ASTM E84 Class 1)	Standard laminate for general structural use: the published values of this section. Not fire-retardant; specify FR-E23 for an ASTM E84 Class 1 requirement.
UP-E17	Isophthalic unsaturated polyester	55–60% by weight	1.8 g/cm³	Standard grade — not fire-retardant (specify an FR grade for ASTM E84 Class 1)	Secondary / lightly-loaded structural grade.
FR-E23	Fire-retardant isophthalic unsaturated polyester	60–70% by weight	1.9 g/cm³	ASTM E84 Class 1 (flame spread ≤ 25), UL 94 V-0 — FR resin; certified test report required per profile	Fire-retardant polyester for fire-code service where chemistry is mild.
VE-E23	Fire-retardant vinyl ester	60–70% by weight	1.85 g/cm³	ASTM E84 Class 1 (flame spread ≤ 25) + low smoke — FR vinyl ester; certified test report required per profile	Vinyl ester matrix for aggressive chemical / marine service (strong acids, bleach, solvents, hydrolysis) and higher service temperature.
EP-E23	Epoxy	60–70% by weight	1.9 g/cm³	Not inherently fire-retardant	Epoxy matrix for elevated-temperature and fatigue-critical service (e.g. wind spar caps).
PU-E23	Polyurethane	65–75% by weight	1.95 g/cm³	Additive-dependent — specify an FR grade for ASTM E84 Class 1	Tough PU matrix for impact / high-strength thin-wall sections (e.g. window frames).
PH-E23	Phenolic	55–65% by weight	1.75 g/cm³	ASTM E84 Class 1 (inherent, no additives), low smoke & low toxicity — phenolic; certified test report required per profile	Phenolic matrix for fire-critical enclosed / occupied service — tunnels, transit interiors, offshore (inherent low flame spread, low smoke & toxicity).

Provenance. The E23-ISO row is the published standard laminate. For the other rows the glass content and density are typical for the resin system, not certified F1 values, and the mechanical minimums are the EN 13706-3 values of the declared grade. Compressive strength, Barcol hardness and water absorption are not specified by EN 13706 — the figures shown are typical industry values for this resin system, pending F1 certified test data; request certified values before final design.

Choosing. Work through the service conditions in order; the first that applies usually decides the matrix. Fire code governs (rail interiors, tunnels, offshore): phenolic, or a fire-retardant polyester or vinyl ester with the test report for the exact formulation. Chemical or marine exposure: vinyl ester checked against the resin supplier's corrosion guide for the chemical, concentration and temperature, with a surface veil. Sustained heat or high-cycle fatigue: epoxy or a high-HDT vinyl ester. Thin walls, fasteners or impact: polyurethane. Otherwise: isophthalic polyester.

Resin system	HDT or Tg (typical)	Signature property	Chemical duty	Fire route
Isophthalic polyester	HDT 80–110 °C	Fastest line speeds, most economical	General atmospheric, mild chemical	ATH-filled grades reach ASTM E84 Class A
Vinyl ester	HDT 100–150 °C	Chemical resistance, toughness, hydrolysis resistance	Acids, chlorides, caustics, immersion, marine	Brominated or ATH grades; Class A available
Polyurethane	HDT 80–110 °C	Transverse strength and impact toughness; thinner walls, screw retention	General duty	FR grades emerging; verify per project
Epoxy	Tg 120–180 °C	Highest mechanicals and fatigue life, low cure shrinkage	Very good, solvent resistant	Add-on FR systems only
Phenolic	Highest service temperature	Inherently low flame spread, smoke and toxicity	Good general duty	Inherent; specified for EN 45545-2 rail, tunnels, offshore

Typical ranges for pultrusion-grade formulations, compiled from resin-supplier technical data sheets and industry references **TYPICAL**; they are not F1 measurements. Formulation-specific values, including every fire result, come from the test report of the formulation quoted.

Physical, thermal and electrical reference values

Reference values are explicitly attributed and are not F1 batch results. "Published reference" rows name their source; "Product-specific" rows must be measured for the offered formulation and are listed so that a specification asks for the right test.

Thermal performance

Thermal insulation, dimensional movement and temperature capability answer different design questions. The resin, cure and fiber direction influence each result.

Property	Reference value or requirement	Basis	Methods
Thermal conductivity, λ	0.3 · EPTA comparison value (W/(m·K))	PUBLISHED REFERENCE	GB/T 3399; ASTM C177, where specimen and apparatus are suitable
Coefficient of thermal expansion, α	11 · EPTA comparison value ($10^{-6}/K$)	PUBLISHED REFERENCE	ASTM E831; GB/T 2572
Glass transition temperature, T_g	Measured for the selected formulation and cure ($^{\circ}C$)	PRODUCT-SPECIFIC	ISO 11357-2 (DSC); ASTM E1640 (DMA)
Heat-deflection temperature, HDT	Test temperature under specified bending stress ($^{\circ}C$ at stated stress)	PRODUCT-SPECIFIC	ISO 75; ASTM D648
Service temperature & thermal cycling	Project-specific temperature envelope ($^{\circ}C$; cycles; retained %)	PRODUCT-SPECIFIC	Agreed aging / cycling and residual-property test plan

Takeaway. T_g , heat-deflection temperature and continuous service temperature are different quantities. Define a service envelope using load, exposure time, moisture and property retention; a material conductivity alone does not establish a window U-value.

Electrical insulation & conductivity

Glass-fiber profiles are commonly selected for electrical insulation, while carbon reinforcement or conductive additives can change conductivity. Specify the complete material and exposure conditions.

Property	Reference value or requirement	Basis	Methods
Dielectric strength	200 V/mil $\approx$ 7.87 kV/mm · NHC PF example (kV/mm)	PUBLISHED REFERENCE	ASTM D149; IEC 60243-1; GB/T 1408.1
Volume resistivity / conductivity	Specify insulation or conductive target ($\Omega\cdot m$ / S/m)	PRODUCT-SPECIFIC	IEC 62631-3-1; ASTM D257 for insulating materials
Surface resistivity	Dry and conditioned results (Ω)	PRODUCT-SPECIFIC	IEC 62631-3-2; ASTM D257
Permittivity & dissipation factor	Values at a specified frequency (Relative ϵ_r ; $\tan \delta$)	PRODUCT-SPECIFIC	ASTM D150
Dry arc resistance & tracking	Separate arc and tracking evaluations (s; method-specific index)	PRODUCT-SPECIFIC	ASTM D495 (dry arc); IEC 60112 (CTI / PTI)

Takeaway. Dielectric breakdown strength is a laboratory result, not an operating-voltage rating. Equipment design must account for creepage, clearance, moisture, contamination, joints and the applicable equipment standard.

Sources: EPTA Pultruded composites in rail; SAMR GB/T 3399-1982; ISO 11357-2:2020; ASTM D149-25; IEC 62631-3-1:2023; IEC 62631-3-2:2023; ASTM D495-22; NHC Electrical properties. The pultruded profile performance guide on the website lists the full registry with links.

03 Design basis

Pultruded FRP is anisotropic, stiffness-driven rather than strength-driven, and it creeps under sustained load. Engineers who specify it well treat it as a discipline of its own rather than as lighter steel. This section sets out the resistance model, factors and load cases behind every table in this manual, so that each value can be reproduced or recalculated for another code.

Six things that differ from steel

- 01 **Deflection governs.** With E_L about a tenth of steel, a member sized for strength alone deflects far past any serviceability limit. Size by stiffness first, then check strength.
- 02 **Direction matters.** Longitudinal values apply to member checks; transverse and shear values govern connections, bearing and local buckling.
- 03 **The connection decides.** Bolt bearing, edge distance and the load direction at a hole often decide whether the structure performs, not the cross-section.
- 04 **Time and environment reduce strength.** Sustained load, moisture, chemicals and temperature carry explicit factors (next pages); none is optional.
- 05 **Thin walls buckle.** Flange outstands and tube walls need local-buckling checks; open sections need lateral-torsional checks.
- 06 **Shear deflection is real.** G_{LT} is only about 3.5 GPa against E_L 23 GPa, so shear adds 5 to 15 percent to

the deflection of ordinary spans and more on short, deep members.

Design workflow

- 01 Fix the loads, combinations and deflection limit from the code adopted where the structure is built (codes by market, in this section).
- 02 Select the laminate and resin for the exposure; take the environment and load-duration factors from this section.
- 03 Size the member for deflection with the section properties of Section 4, shear deflection included.
- 04 Check bending and shear strength against the factored demand; check local and lateral-torsional stability.
- 05 Detail the connections: bearing, edge distances, washers, isolation from steel.
- 06 Send span, loads, support conditions and code to F1 engineering for a checked section before the order.

Scope of the tables. Simply supported prismatic members under one idealized load case, strong-axis bending, uniform section. Not covered: lateral-torsional buckling, local plate buckling, web crippling, bearing, connections, fatigue, fire, creep deflection and rupture, vibration, combined axial and bending, biaxial bending, principal-axis angle design, continuous beams, frames and second-order effects. The F1 column tool screens axial members (page 18).

Codes by market

Loads come from where the structure is built; only two documents design pultruded shapes

Market	Loads and main combinations	Pultruded FRP design document	Related documents
United States	ASCE 7-22 through the IBC: 1.4D; 1.2D + 1.6L	ASCE/SEI 74-23 (LRFD for pultruded GFRP shapes and connections)	OSHA 29 CFR 1910 Subpart D for workplace access; ASTM D3917 dimensional tolerances
European Union	EN 1990:2023 and EN 1991: 1.35·k _F ·G; 1.5·k _F ·Q (k _F = 1.0 for CC2), national annexes	CEN/TS 19101:2022, Eurocode expected by 2028	EN 13706 product specification; EN ISO 14122 for machinery access
United Kingdom	BS EN 1990 and BS EN 1991 with UK National Annexes	PD CEN/TS 19101:2022	BS EN 13706; BS EN ISO 14122 for machinery access
Canada	NBC Part 4 (NBC 2020; NBC 2025 published December 2025, adopted by each province on its own timetable; check the edition in force): 1.4D; 1.25D + 1.5L	No standard specific to pultruded shapes; CSA S806 covers self-supporting FRP components and FRP-reinforced or strengthened concrete in buildings and is the usual Canadian reference	CSA S6:25 for bridges; CSA S807 for FRP bars
Australia	AS/NZS 1170.0 and 1170.1: 1.35G; 1.2G + 1.5Q	No Australian standard for pultruded shapes; published Australian design guides use the ASCE LRFD approach with AS/NZS 1170 loads	AS 1657:2018 for platforms, walkways, stairs and ladders; AS 5204:2023 for FRP bars
New Zealand	AS/NZS 1170.0 and 1170.1 through NZBC B1: 1.35G; 1.2G + 1.5Q	No New Zealand standard for pultruded shapes; the resistance model is agreed with the building consent authority	NZBC D1 and F4 for access routes and barriers

What each document contributes

ASCE/SEI 74-23 is the US load-and-resistance-factor design standard for structures of pultruded GFRP shapes, connections and prefabricated products. This manual uses its resistance factors and the time-effect factors of the 2010 ASCE LRFD Pre-Standard it builds on; it does not reproduce the standard chapter by chapter.

CEN/TS 19101:2022 is the European technical specification for fiber-polymer composite structures; CEN intends to turn it into a Eurocode by 2028, and until then a project adopts it explicitly. Its actions come from EN 1990:2023, where the partial factors are 1.35·k_F and 1.5·k_F with k_F = 1.0 for consequence class CC2.

EN 13706 is a product specification, not a design standard: it fixes the grade minimums and test methods used in Section 2. **ASTM D3917** covers dimensional tolerances only. **GB 50608-2020** and **T/CECS 692-2020** form the Chinese design path and keep their own load and resistance factors together.

Where no national document exists (Canada, Australia, New Zealand), the engineer adopts ASCE/SEI 74-23 or CEN/TS 19101 as the resistance model with the local loads, and justifies it to the authority having jurisdiction. The ASCE live-load factor of 1.6 is conservative against the 1.5 of AS/NZS 1170.0 and the NBC.

Resistance model, load duration and environment

Design strength = $\phi \cdot \lambda \cdot F_k \cdot C_{env}$, compared with the factored stress. F_k is $\min(F_{tL}, F_{cL})$ for bending and the shear strength for shear. On the ASCE path λ is the time-effect factor of the load duration; the CEN path uses γ_M with the EN 1990 variable-action factor and no creep conversion for permanent loads, which therefore need a separate check.

Method	ϕ bending	ϕ shear	Load factor on the variable action	Basis
Preliminary LRFD screen, ASCE/SEI 74-23	0.65	0.65	1.6	Preliminary global beam screen using ASCE/SEI 74-23-style ϕ , the time-effect factor λ and ASCE 7-22 load factors; not a complete code check
Preliminary partial-factor screen, CEN/TS 19101:2022	0.667	0.667	1.5	Preliminary global beam screen using CEN/TS 19101-style $\gamma_M = 1.5$ and EN 1990:2023 variable-action γ_Q (CC2, $k_F = 1.0$); creep conversion for permanent loads is not modeled; not a complete code check
Preliminary LRFD screen, GB 50608-2020	0.625	0.625	1.5	Preliminary global beam screen using GB 50608-style γ_R and GB 55001 variable-action γ_Q ; not a complete code check
Preliminary ASD screen, user-selected properties	0.4	0.333	1	Preliminary allowable-stress screen: F/2.5 bending and F/3.0 shear; not a code compliance check

Time-effect factor λ (ASCE path)

Load duration	λ	Load factor
Live load from occupancy (1.2D + 1.6L)	0.8	1.6
Live load from storage (1.2D + 1.6L)	0.6	1.6
Permanent load only (1.4D)	0.4	1.4
Wind or earthquake (1.0W, 1.0E)	1	1

Values of the ASCE LRFD Pre-Standard for pultruded FRP (2010), Table 2.3-1, on which ASCE/SEI 74-23 builds. A member under permanent load alone keeps only 40 percent of its short-term design strength.

Environment factors (screening)

Service environment	Strength	Stiffness
Indoor, dry, $\leq 30^\circ\text{C}$	1	1
Outdoor, exposed (UV + humidity)	0.85	1
Wet / immersion	0.75	0.9
Mild chemical (acid/alkali)	0.75	1
Elevated temperature (32–60 °C)	0.7	1

Indoor: Reference; no knockdown. **Outdoor:** In line with the moisture conversion factor CEN/TS 19101 uses for outdoor exposure not continuously wet. **Wet / immersion:** ASCE/SEI 74-23 wet-service adjustment for a polyester matrix: 0.75 on strength, 0.90 on stiffness. **Mild chemical (acid/alkali):** F1 screening value; resin-specific chemical data are needed. **Elevated temperature (32–60 °C):** F1 screening value; stiffness also falls, so ask for resin data. ASCE/SEI 74-23 limits service temperature to $T_g - 22^\circ\text{C}$.

Material inputs and deflection limits

Materials the tools compare

Material	Standard	E (GPa)	E _T (GPa)	G _{LT} (GPa)	Strength (MPa)	F _{CL} (MPa)	Shear (MPa)	Density (g/cm³)
FRP EN 13706 E17	EN 13706-3:2002 minimums	17	5	3	170	140	15	1.9
FRP EN 13706 E23	EN 13706-3:2002 minimums	23	7	3.5	240	200	25	1.9
FRP GB 50608 Class I	GB 50608-2020 / T/CECS 692-2020	23	7	3.5	240	200	30	1.9
FRP GB 50608 Class II	GB 50608-2020 / T/CECS 692-2020	17	5	3	170	140	25	1.9
Steel S235 (EN 10025-2)	EN 10025-2	210	—	—	235	—	—	7.85
Steel S355 (EN 10025-2)	EN 10025-2	210	—	—	355	—	—	7.85
Steel ASTM A36 (US)	ASTM A36/A36M	200	—	—	250	—	—	7.85
Steel ASTM A992 (US)	ASTM A992/A992M	200	—	—	345	—	—	7.85
Steel CSA G40.21 350W (Canada)	CSA G40.21	200	—	—	350	—	—	7.85
Steel AS/NZS 3679.1 Grade 300 (AU/NZ)	AS/NZS 3679.1 (nominal grade)	200	—	—	300	—	—	7.85
Steel Q235 (GB/T 700)	GB/T 700-2006	206	—	—	235	—	—	7.85
Steel Q355B (GB/T 1591)	GB/T 1591-2018 (t ≤ 16 mm)	206	—	—	355	—	—	7.85
Aluminum 6061-T6	EN 1999-1-1 Table 3.2b (EN AW-6061 T6) / ASTM B221	70	—	—	240	—	—	2.7
Aluminum 6063-T5	EN 1999-1-1 Table 3.2b (EN AW-6063 T5, 3-25 mm) / ASTM B221	70	—	—	110	—	—	2.7

FRP rows: EN 13706-3 minimums for E, E_T, tensile strength and interlaminar shear; G_{LT} and F_{CL} are stated assumptions (not in EN 13706), and "strength" is the longitudinal tensile strength. Metals: minimum yield strength of the product standard and the modulus of the matching design code. A stiffness comparison at equal section uses E; a like-for-like member comparison needs the deflection limit, because the FRP member is deflection-governed and the steel one usually strength-governed.

Deflection limits in common use

Limit	Where it is used	Note
L/180	Industrial platforms and equipment supports where economy governs	Lowest limit normally accepted for walking surfaces; IBC Table 1604.3 live-load limit for roof members not supporting a ceiling
L/240	Floors under dead plus live load; roofs with non-plaster ceilings	IBC Table 1604.3: D + L limit for floor members, live-load limit for roof members with non-plaster ceilings
L/250	The span tables in Section 5	Common serviceability limit for walkways; EN 1990 national annexes often use L/250 for floors
L/360	Floors under live load, public access, brittle finishes	IBC Table 1604.3 live-load limit for floor members and for roof members supporting plaster; bridges often tighter, with a vibration check
30 mm	Guard rails to EN ISO 14122-3 under the test load	Horizontal deflection at the hand rail, not a ratio

Limits are the project's to set; the ranking of sections does not change between them, but the deflection-governed values scale with the limit (shear-governed cells do not), so run the calculator with the exact limit when it differs from L/250.

Load effects, deflection and section formulas

Load case	Maximum moment	Bending deflection	Shear coefficient c
Simple span, UDL	$wL^2/8$	$5wL^4/(384EI_x)$	9.6
Simple span, mid-point load	$PL/4$	$PL^3/(48EI_x)$	12
Cantilever, tip load	PL	$PL^3/(3EI_x)$	3
Cantilever, UDL	$wL^2/2$	$wL^4/(8EI_x)$	4

Bending stress is M/W_x ; the average shear check is V/A_v . Total deflection applies a load-case-matched Timoshenko correction:

$$\delta_{\text{total}} = \delta_b \cdot [1 + c \cdot E \cdot I_x / (G \cdot A_v \cdot L^2)]$$

For wet service both moduli are reduced by the stiffness factor before the deflection is calculated. Strength checks use the factored load; deflection stays a service-load calculation, so a load factor is never applied twice.

Section properties

I-beams and channels: $I_x = [B \cdot H^3 - (B - t_w) \cdot (H - 2t_f)^3] / 12$. Square and rectangular tubes: outer rectangle minus the concentric inner rectangle. Round tubes: $I = \pi \cdot (R_o^4 - R_i^4) / 4$ and $A = \pi \cdot (R_o^2 - R_i^2)$. Angles: two non-overlapping rectangles, centroid first, then the parallel-axis theorem; W_x uses the farther extreme fiber from the calculated centroid. The shear area A_v is the clear web for I-beams and channels, the two side walls between the flanges, $2 \cdot (H - 2t) \cdot t$, for box sections, half the annulus for round tubes and the loaded leg for angles. These are classical geometry identities; Section 4 tabulates them for every size.

Checking a member by hand

- 01 Service moment $M = wL^2/8$ (or the case above); bending stress $\sigma = M / W_x$; compare $\gamma \cdot \sigma$ with the design bending strength of the chosen method.
- 02 Service shear $V = wL/2$; average shear stress $\tau = V / A_v$; compare $\gamma \cdot \tau$ with the design shear strength.
- 03 Service deflection $\delta = 5wL^4 / (384 \cdot E \cdot I_x) \times [1 + 9.6 \cdot E \cdot I_x / (G \cdot A_v \cdot L^2)]$; compare with L/n .
- 04 The lowest of the three allowable loads governs; the worked example on the next page shows the arithmetic for one catalog section.

Worked example: a walkway beam

I 200×100×10 · 3 m simple span · uniform load

Inputs

Section	I 200×100×10 (H 200, B 100, t _f = t _w = 10 mm)
A, I _x , W _x , A _v	3,800 mm ² , 2,292.7 cm ⁴ , 229.3 cm ³ , 1,800 mm ² CALCULATED
Material	EN 13706 Grade E23 (E-glass pultruded): E _L 23 GPa, G _{LT} 3.5 GPa (assumed), F _{CL} 200 MPa (assumed, below the 240 MPa typical value of Section 2 because EN 13706 specifies no compressive strength and the typical value is not certified), shear 25 MPa
Method	LRFD, ASCE/SEI 74-23 (φ = 0.65, λ = 0.8 for occupancy live load, γ _Q = 1.6)

Environment	Outdoor exposed (0.85 on strengths); stiffness factor 1.0
Design strengths	bending 0.65 × 0.8 × 200 × 0.85 = 88.4 MPa ; shear 0.65 × 0.8 × 25 × 0.85 = 11.05 MPa
Serviceability	L/250 = 12 mm at service load
Allowable service UDL, w (N/mm = kN/m)	
Bending	w _b = 8·F _b ·W _x / (γ _Q ·L ²) = 11.26 kN/m
Shear	w _v = 2·F _v ·A _v / (γ _Q ·L) = 8.29 kN/m
Shear correction	k = 1 + 9.6·E·I _x / (G·A _v ·L ²) = 1.089
Deflection	w _d = 384·E·I _x / (5·250·L ³ ·k) = 5.51 kN/m
Governing	5.51 kN/m , deflection governs (Section 5 table: 5.5 kN/m, "d")

At 5.51 kN/m the beam uses 49 percent of its bending capacity and 66 percent of its shear capacity, which is the normal picture for pultruded FRP: the deflection limit, not strength, sets the load. Shear deformation adds 9 percent to the bending deflection at this span-to-depth ratio of 15.

The same section in steel

For a like-for-like stiffness comparison, a steel member needs only E_{FRP}/E_{steel} = 23/210 ≈ 0.11 of the second moment of area to deflect the same amount, so the FRP replacement for a steel beam is usually deeper. Its mass is not: at the nominal area this I 200×100×10 is 7.2 kg/m in FRP (1.9 g/cm³; catalog mass 5.8 kg/m) against 29.8 kg/m in steel (7.85 g/cm³).

The FRP profile calculator on the website reproduces this example and accepts another section, span, load type, code, environment and deflection limit. Its validation page recomputes published benchmarks from the same engine on every site build.

Compression members

Global buckling with shear correction, local plate buckling, crushing

Pultruded columns fail by one of three mechanisms, and all three are plate or column mechanics rather than code coefficients:

- **Global flexural buckling** about each axis, Euler with the Engesser shear correction: $P = P_E / (1 + P_E / (G \cdot A_v))$, $P_E = \pi^2 \cdot E_L \cdot I / (K \cdot L)^2$. The correction is worth a few percent on stocky members.
- **Local buckling** of each wall as a long orthotropic plate with simply supported junctions (a lower bound): flange outstand with one free edge, $b = B/2$, $\sigma = G_{LT} \cdot (t/b)^2$; web or tube wall held on both edges, $b = H - t$ (the widest wall for a tube), $\sigma = (\pi^2/6) \cdot (t/b)^2 \cdot [\sqrt{E_L \cdot E_T} + \nu_{LT} \cdot E_T + 2 \cdot G_{LT}]$, with $\nu_{LT} = 0.3$ unless measured.
- **Crushing**: $F_{CL} \cdot A$.

Every mode takes the bending resistance factor of the chosen method (and λ on the ASCE path).

ASCE/SEI 74–23 is understood to allow higher factors for buckling, but they were not confirmed against the published text, so the lower factor is used as the conservative choice. Flexural–torsional buckling of open sections, local–global interaction, eccentric load and creep are flagged, not calculated: channels and angles as columns need a separate check.

Effective length factors K

End conditions	K
Pinned at both ends	1
Fixed base, pinned top	0.8
Fixed at both ends	0.65
Fixed base, free top (flagpole)	2.1

Recommended design values for ideal end conditions, AISC 360 Commentary Table C–A–7.1. Keep KL/r below 200.

Example: I 200×100×10 as a 3 m pinned column, indoor, occupancy live load

Mode	Critical stress (MPa)	Nominal capacity (kN)	Design capacity (kN)
Global buckling, strong axis	139.4	529.6	275.4
Global buckling, weak axis GOVERNS	11.1	42.1	21.9
Local buckling, flange	140	532	276.6
Local buckling, web	99.3	377.3	196.2
Crushing (compressive strength)	200	760	395.2

Slenderness KL/r : 39 about x, 143 about y. Resistance factor 0.65, λ 0.8; the design capacity is the nominal capacity $\times 0.52$. The weak-axis Euler load of 42 kN is the hand-calculation check: $\pi^2 \times 23 \text{ GPa} \times 168 \text{ cm}^4 / (3 \text{ m})^2$ corrected for shear. Bracing the weak axis at mid-height raises that mode to about 165 kN nominal (just under four times, because the shear correction grows with the Euler load) and it still governs (global buckling, weak axis); at third points it reaches about 358 kN, close to the local-buckling values of the walls (web 377 kN, flange 532 kN), which set the limit of any more closely braced wide-flange FRP column.

Connections and thermal movement

Bolted connections

Bearing at the hole is the usual limit. EN 13706 E23 guarantees a pin-bearing strength of 150 MPa along the profile and 70 MPa across it (EN 13706-2 Annex E). The design bearing stress takes the connection resistance factor of the project code (ASCE/SEI 74-23 Chapter 8, lower than the flexural ϕ used for members, with λ and the environment factor; CEN/TS 19101 its own γ_M), which is why this manual tabulates no bolt capacities. Detail with:

- Specify edge distance, end distance, hole clearance and any slots on the approved connection drawing. Their limits depend on load direction, laminate, fastener and project code; do not assume steel detailing or one bolt-diameter multiplier applies to every FRP joint.
- Use the specified washers and any sleeves or backing plates to distribute clamping force. Follow the approved tightening method for the joint and hardware; excessive clamping can crush the laminate. This manual gives no universal torque or preload.

- Check the specified load direction: transverse and longitudinal pin-bearing strengths differ.
- Stainless-steel (A2/A4) or FRP fasteners. Where carbon-steel hardware is unavoidable, isolate it with sleeves and washers and keep water out of the joint: "FRP corrosion" at a joint is normally an unprotected steel fastener rusting in trapped moisture or a galvanic couple between dissimilar metals; the laminate itself is an insulator.
- Net-section tension, shear-out and block-shear checks to ASCE/SEI 74-23 Chapter 8 or CEN/TS 19101 for the governing case; this manual does not tabulate bolt-group capacities.

Bonded and hybrid joints

Adhesive joints spread load over an area instead of a hole and suit fatigue-loaded and sealed details; mostly static joints do not need them. Use a structural adhesive qualified for the resin system, abrade and solvent-clean the faying surfaces, control the bond-line thickness and allow full cure before loading. Hybrid (bonded plus bolted) joints hold the parts during cure and give a second load path.

Thermal movement

Free movement $\Delta L = \alpha \cdot L \cdot \Delta T$; fully restrained axial stress $\sigma = E \cdot \alpha \cdot \Delta T$. Lengthwise, pultruded GFRP moves about as much as glass or concrete and less than steel or aluminum, so an FRP member fixed to a steel or aluminum frame moves relative to it; crosswise the coefficient is several times higher because the resin controls it.

Declare the value measured for the supplied profile when the specification needs it.

Example: a 6 m FRP rail installed at 20 °C and reaching 50 °C grows 1.4 mm; the same rail in aluminum grows 4.1 mm. Allow for the difference at every fixing to a dissimilar frame, and size sealant joints for the full annual range with the sealant's movement class.

Material	α ($10^{-6}/K$)	E (GPa)	Movement, 6 m, ± 30 K	Source
Pultruded GFRP profile, lengthwise	8	23	± 1.4 mm	Typical E-glass pultrusion; manufacturer design manuals give about $6-11 \times 10^{-6}/K$. Declare the supplied value
GFRP rebar, lengthwise	8	50	± 1.4 mm	ACI 440.1R-15 §4.1.2, longitudinal range $6.0-10.0 \times 10^{-6}/K$
Carbon steel	12	210	± 2.2 mm	EN 1993-1-1 §3.2.6
Stainless steel 1.4301 / 1.4401 (304 / 316)	16	200	± 2.9 mm	EN 1993-1-4 §2.1.3
Aluminum alloy	23	70	± 4.1 mm	EN 1999-1-1 §3.2.5
Concrete	10	33	± 1.8 mm	EN 1992-1-1 §3.1.3(5)
Soda-lime glass	9	70	± 1.6 mm	EN 572-1 Table 1

The EPTA comparison value of $11 \times 10^{-6}/K$ in Section 2 lies at the top of the lengthwise range manufacturer manuals give for E-glass pultrusions and would make the 6 m example 2 mm; the website tools and this table use $8 \times 10^{-6}/K$. Use the value declared for the supplied profile when the specification needs it.

04 Section tables

All 114 catalog sizes with the published mass per meter and the section properties of the nominal, sharp-cornered section, computed by the same engine as the per-size datasheets and the span tables. Masses are F1-published values, never computed from the area; areas and second moments are geometric derivations. Each size has a datasheet at www.f1composite.com/datasheets/<designation>, and a DXF drawing where marked.

Conventions

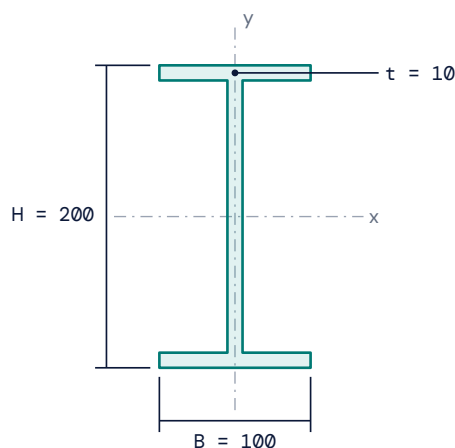
- **Axes.** x-x is the horizontal centroidal axis in the drawing, y-y the vertical one; I_x is the second moment of area about x-x, $W_x = I_x/c$ with c the farther extreme fiber, $r_x = \sqrt{I_x/A}$.
- **Units.** Dimensions in mm, A in mm², I in cm⁴ (1 cm⁴ = 10⁴ mm⁴), W in cm³ (1 cm³ = 10³ mm³), r in mm. Four significant figures, as on the datasheets.
- **Mass.** The catalog value in kg/m, with its own precision; it includes the surface veil and the as-pultruded corners, so it is not exactly A × density.
- **Thickness.** Catalog I-beams and channels have equal flange and web thickness t; tubes a uniform wall t.

- **Inch sizes.** Sizes such as 76×38×6.4, 152×152×12.7 and 305×305×12.7 are the imperial 3, 6 and 12 in sections; the website unit converter matches an inch size to the nearest catalog size.

Tolerances and drawings

The properties are nominal. Confirm the applicable tolerance standard, edition and class, and evaluate the permitted dimensions before accepting a final capacity. Raw-profile limits do not establish finished-hole or cut-length tolerances. DXF drawings (●) are the nominal outline for CAD; STEP models are supplied on request.

FIG. 2 I-beams



I 200×100×10 · scale 1:5

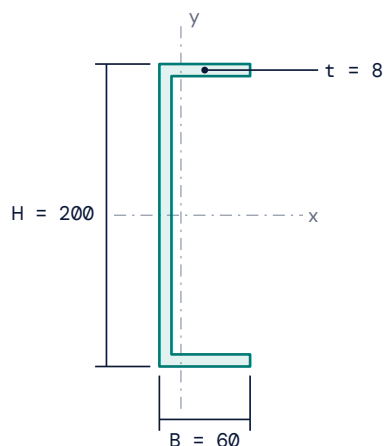
Equal-flange I-beams and wide flanges. I_x is about the horizontal axis through the web, the normal spanning direction. The wide-flange I 305×305×12.7 is the imperial 12 × 12 in section.

Designation	H (mm)	B (mm)	t (mm)	Mass (kg/m)	A (mm ²)	I_x (cm ⁴)	W_x (cm ³)	r_x (mm)	I_y (cm ⁴)	W_y (cm ³)	r_y (mm)	DXF
I 76×38×6.4	76	38	6.4	1.2	890.9	72.53	19.09	28.53	5.991	3.153	8.201	●
I 100×50×6	100	50	6	1.6	1,128	166.8	33.36	38.45	12.66	5.063	10.59	●
I 120×60×6	120	60	6	2	1,368	297.1	49.52	46.6	21.79	7.265	12.62	●
I 152×76×6.4	152	76	6.4	2.9	1,864	659.8	86.81	59.5	47.13	12.4	15.9	●
I 160×80×8	160	80	8	3.6	2,432	939.1	117.4	62.14	68.88	17.22	16.83	●
I 200×100×10	200	100	10	5.8	3,800	2,293	229.3	77.67	168.2	33.63	21.04	●
I 240×120×12	240	120	12	8.4	5,472	4,754	396.2	93.21	348.7	58.12	25.24	●
I 300×150×15	300	150	15	13.5	8,550	11,610	773.8	116.5	851.3	113.5	31.56	●
I 305×305×12.7	305	305	12.7	16	11,300	18,870	1,237	129.2	6,010	394.1	72.94	●

Channels

19 sizes

FIG. 3 Channels



U 200×60×8 · scale 1:5

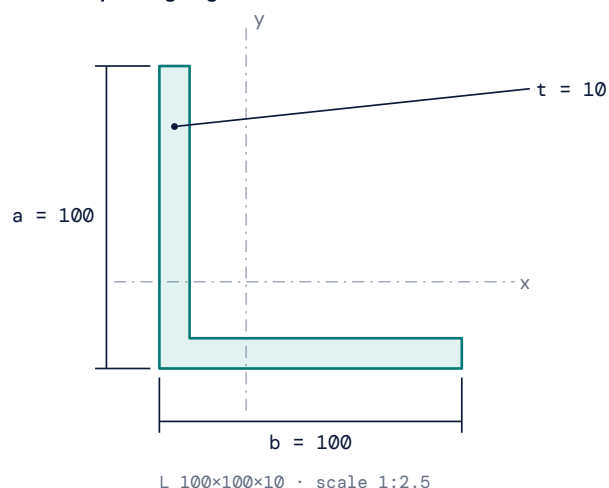
U-profiles, web vertical. I_x is about the axis parallel to the flanges (web spanning), the way a stringer or a cable-tray rail is loaded; I_y is about the axis through the web and back-to-back pairs double it. Single channels loaded away from the shear center twist: brace or pair them.

Designation	H (mm)	B (mm)	t (mm)	Mass (kg/m)	A (mm ²)	I_x (cm ⁴)	W_x (cm ³)	r_x (mm)	I_y (cm ⁴)	W_y (cm ³)	r_y (mm)	DXF
U 38×13×4.8	38	13	4.8	0.4	261.1	4.379	2.305	12.95	0.3115	0.3605	3.454	●
U 50×25×5	50	25	5	0.7	450	15.38	6.15	18.48	2.455	1.449	7.386	●
U 76×25×6.4	76	25	6.4	1	724.5	52.33	13.77	26.87	3.35	1.893	6.8	●
U 76×38×6.4	76	38	6.4	1.4	890.9	72.53	19.09	28.53	11.5	4.395	11.36	●
U 100×30×6	100	30	6	1.5	888	113.7	22.74	35.78	5.941	2.684	8.179	●
U 100×50×6	100	50	6	1.8	1,128	166.8	33.36	38.45	26.25	7.437	15.26	●
U 120×50×6	120	50	6	2	1,248	258.1	43.02	45.48	27.77	7.625	14.92	●
U 150×40×6	150	40	6	2.1	1,308	380.4	50.72	53.93	15.43	5.016	10.86	●
U 152×43×6.4	152	43	6.4	2.2	1,441	435.7	57.33	54.98	20.18	6.15	11.83	●
U 152×43×9.5	152	43	9.5	3.2	2,081	601.6	79.16	53.77	27.46	8.67	11.49	●
U 160×48×8	160	48	8	3	1,920	643.1	80.38	57.87	33.79	9.387	13.27	●
U 200×60×8	200	60	8	3.8	2,432	1,301	130.1	73.13	68.86	15.06	16.83	●
U 200×60×10	200	60	10	4.6	3,000	1,570	157	72.34	82.5	18.33	16.58	●
U 240×72×8	240	72	8	4.6	2,944	2,300	191.7	88.39	122.5	22.09	20.4	●
U 240×72×12	240	72	12	6.8	4,320	3,256	271.3	86.81	171.1	31.68	19.9	●
U 254×76×9.5	254	76	9.5	5.6	3,677	3,187	250.9	93.1	168.1	28.89	21.38	●
U 300×90×15	300	90	15	10.4	6,750	7,948	529.9	108.5	417.7	61.88	24.87	●
U 305×89×12.7	305	89	12.7	8.8	5,812	7,145	468.5	110.9	355	52.36	24.72	●
U 360×108×18	360	108	18	15	9,720	16,480	915.6	130.2	866.1	106.9	29.85	●

Angles

15 sizes

FIG. 4 Equal-leg angles



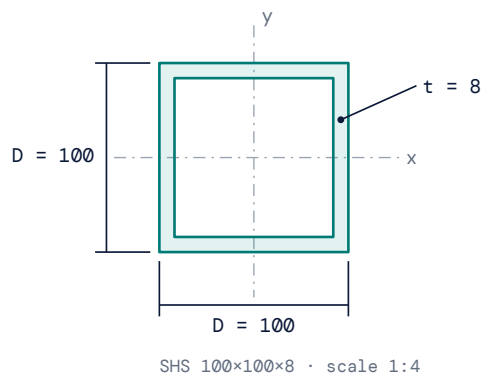
Equal-leg angles. I_x is about the centroidal axis parallel to a leg, for preliminary sizing only: a single angle bends about its principal axes, which lie at 45° , so a span check needs the principal-axis properties and a restraint check. Angles are not in the span tables for that reason.

Designation	a (mm)	b (mm)	t (mm)	Mass (kg/m)	A (mm ²)	I_x (cm ⁴)	W_x (cm ³)	r_x (mm)	I_y (cm ⁴)	W_y (cm ³)	r_y (mm)	DXF
L 25×25×3.2	25	25	3.2	0.3	149.8	0.8654	0.4923	7.602	0.8654	0.4923	7.602	●
L 30×30×4	30	30	4	0.4	224	1.855	0.882	9.101	1.855	0.882	9.101	●
L 38×38×4.8	38	38	4.8	0.5	341.8	4.569	1.709	11.56	4.569	1.709	11.56	●
L 50×50×5	50	50	5	0.8	475	11.25	3.155	15.39	11.25	3.155	15.39	●
L 50×50×6	50	50	6	0.9	564	13.13	3.719	15.26	13.13	3.719	15.26	●
L 50×50×8	50	50	8	1.2	736	16.57	4.79	15	16.57	4.79	15	●
L 65×65×6	65	65	6	1.2	744	29.99	6.444	20.08	29.99	6.444	20.08	●
L 75×75×6	75	75	6	1.4	864	46.88	8.677	23.29	46.88	8.677	23.29	●
L 75×75×8	75	75	8	1.8	1,136	60.18	11.29	23.02	60.18	11.29	23.02	●
L 76×76×6.4	76	76	6.4	1.5	931.8	51.72	9.467	23.56	51.72	9.467	23.56	●
L 100×100×8	100	100	8	2.5	1,536	148.2	20.57	31.06	148.2	20.57	31.06	●
L 100×100×10	100	100	10	3	1,900	180	25.24	30.78	180	25.24	30.78	●
L 102×102×9.5	102	102	9.5	3	1,848	183.2	25.1	31.49	183.2	25.1	31.49	●
L 150×150×12	150	150	12	5.6	3,456	750.1	69.42	46.59	750.1	69.42	46.59	●
L 152×152×12.7	152	152	12.7	6	3,700	821.9	75.19	47.13	821.9	75.19	47.13	●

Square and rectangular tubes

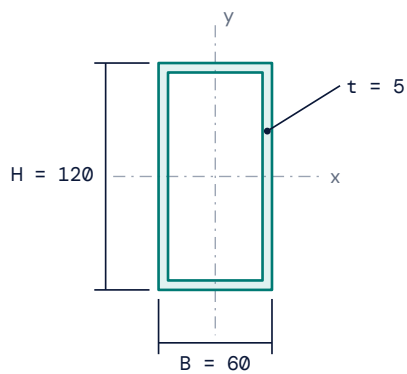
15 square + 5 rectangular sizes

FIG. 5 Square hollow section



Square hollow sections. Side D, wall t; $I_x = I_y$. The closed section gives the torsional stiffness that frames, posts and trusses need.

FIG. 6 Rectangular hollow section



Rectangular hollow sections, H deep and B wide; I_x is about the axis parallel to B (depth spanning). The span tables use the deep orientation.

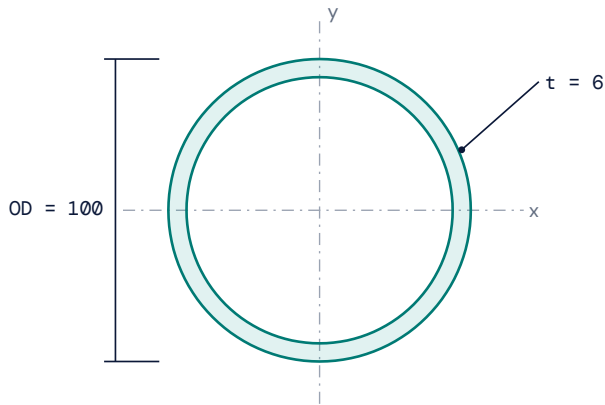
Designation	D (mm)	t (mm)	Mass (kg/m)	A (mm ²)	I_x (cm ⁴)	W_x (cm ³)	r_x (mm)	I_y (cm ⁴)	W_y (cm ³)	r_y (mm)	DXF
SHS 25×25×3.2	25	3.2	0.4	279	2.258	1.806	8.995	2.258	1.806	8.995	●
SHS 38×38×4.8	38	4.8	0.9	637.4	11.95	6.292	13.69	11.95	6.292	13.69	●
SHS 50×50×5	50	5	1.4	900	30.75	12.3	18.48	30.75	12.3	18.48	●
SHS 60×60×5	60	5	1.7	1,100	55.92	18.64	22.55	55.92	18.64	22.55	●
SHS 75×75×6	75	6	2.5	1,656	132.4	35.31	28.28	132.4	35.31	28.28	●
SHS 100×100×6	100	6	3.5	2,256	333.6	66.72	38.45	333.6	66.72	38.45	●
SHS 100×100×8	100	8	4.5	2,944	418.4	83.69	37.7	418.4	83.69	37.7	●
SHS 114×114×6	114	6	4	2,592	505.4	88.67	44.16	505.4	88.67	44.16	●
SHS 114×114×8	114	8	5.2	3,392	638.8	112.1	43.4	638.8	112.1	43.4	●
SHS 120×120×8	120	8	5.6	3,584	753.1	125.5	45.84	753.1	125.5	45.84	●
SHS 132×132×9.5	132	9.5	7	4,655	1,171	177.5	50.16	1,171	177.5	50.16	●
SHS 152×152×9.5	152	9.5	8.2	5,415	1,841	242.2	58.3	1,841	242.2	58.3	●
SHS 160×160×8	160	8	7.4	4,864	1,878	234.8	62.14	1,878	234.8	62.14	●
SHS 200×200×10	200	10	11.6	7,600	4,585	458.5	77.67	4,585	458.5	77.67	●
SHS 240×240×12	240	12	16.8	10,940	9,508	792.3	93.21	9,508	792.3	93.21	●

Designation	H (mm)	B (mm)	t (mm)	Mass (kg/m)	A (mm ²)	I_x (cm ⁴)	W_x (cm ³)	r_x (mm)	I_y (cm ⁴)	W_y (cm ³)	r_y (mm)	DXF
RHS 40×20×7	40	20	7	1	644	9.788	4.894	12.33	2.62	2.62	6.378	●
RHS 40×25×8	40	25	8	1.2	784	12.3	6.148	12.52	5.063	4.05	8.036	●
RHS 80×60×5	80	60	5	2	1,300	113.1	28.27	29.49	71.08	23.69	23.38	●
RHS 100×60×8	100	60	8	3.6	2,304	282.7	56.54	35.03	120.4	40.12	22.86	●
RHS 120×60×5	120	60	5	2.6	1,700	309.4	51.57	42.66	101.4	33.81	24.42	●

Round tubes

17 sizes

FIG. 7 Circular hollow section



Circular hollow sections, outside diameter and wall. I and W are the same about every axis. The dimensions define a structural section, not a pressure rating.

CHS 100×6 · scale 1:2.5

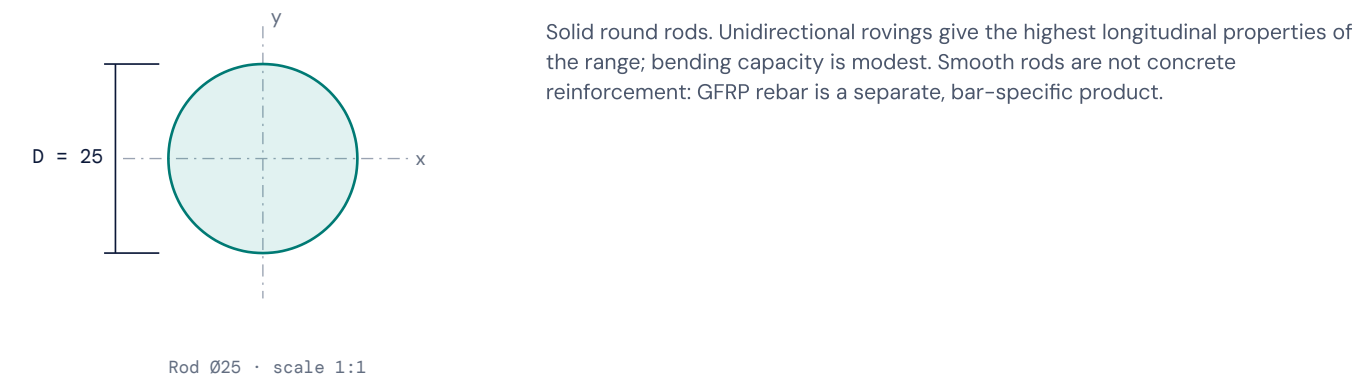
Designation	OD (mm)	t (mm)	Mass (kg/m)	A (mm²)	I _x (cm⁴)	W _x (cm³)	r _x (mm)	DXF
CHS 25×3	25	3	0.3	207.3	1.278	1.022	7.85	●
CHS 32×3	32	3	0.4	273.3	2.904	1.815	10.31	●
CHS 38×3.2	38	3.2	0.5	349.8	5.341	2.811	12.36	●
CHS 42×4	42	4	0.7	477.5	8.715	4.15	13.51	●
CHS 50×4	50	4	0.9	578.1	15.41	6.162	16.32	●
CHS 50×5	50	5	1.1	706.9	18.11	7.245	16.01	●
CHS 60×5	60	5	1.3	863.9	32.94	10.98	19.53	●
CHS 63.5×6.4	63.5	6.4	1.7	1,148	47.38	14.92	20.31	●
CHS 70×5	70	5	1.6	1,021	54.24	15.5	23.05	●
CHS 76×6.4	76	6.4	2.1	1,399	85.45	22.49	24.71	●
CHS 80×5	80	5	1.8	1,178	83.2	20.8	26.58	●
CHS 80×7	80	7	2.5	1,605	107.9	26.98	25.93	●
CHS 89×6.4	89	6.4	2.5	1,661	142.5	32.02	29.29	●
CHS 100×6	100	6	2.7	1,772	196.5	39.3	33.3	●
CHS 114×6.4	114	6.4	3.3	2,163	314.2	55.12	38.11	●
CHS 127×6.4	127	6.4	3.7	2,425	442.1	69.62	42.7	●
CHS 150×8	150	8	5.4	3,569	902.4	120.3	50.28	●

Approximate inch sizes: Ø25 ≈ 1 in, Ø38 ≈ 1½ in, Ø50 ≈ 2 in, Ø63.5 = 2½ in, Ø76 ≈ 3 in, Ø89 ≈ 3½ in, Ø114 ≈ 4½ in, Ø127 = 5 in outside diameter. Inch figures are references, not separate inch tooling or tolerances.

Solid rods

16 sizes

FIG. 8 Solid rod



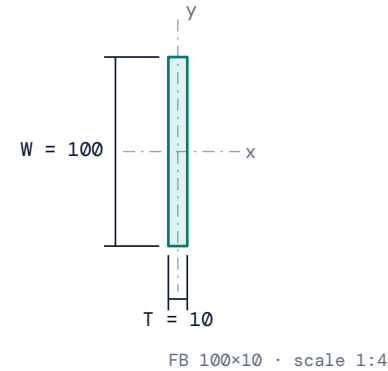
Designation	D (mm)	Mass (kg/m)	A (mm²)	I _x (cm⁴)	W _x (cm³)	r _x (mm)	DXF
Rod Ø6	6	0.05	28.27	0.006362	0.02121	1.5	●
Rod Ø8	8	0.09	50.27	0.02011	0.05027	2	●
Rod Ø10	10	0.14	78.54	0.04909	0.09817	2.5	●
Rod Ø12	12	0.21	113.1	0.1018	0.1696	3	●
Rod Ø13	13	0.24	132.7	0.1402	0.2157	3.25	●
Rod Ø16	16	0.37	201.1	0.3217	0.4021	4	●
Rod Ø19	19	0.52	283.5	0.6397	0.6734	4.75	●
Rod Ø20	20	0.57	314.2	0.7854	0.7854	5	●
Rod Ø22	22	0.69	380.1	1.15	1.045	5.5	●
Rod Ø25	25	0.89	490.9	1.917	1.534	6.25	●
Rod Ø28	28	1.12	615.8	3.017	2.155	7	●
Rod Ø30	30	1.29	706.9	3.976	2.651	7.5	●
Rod Ø32	32	1.47	804.2	5.147	3.217	8	●
Rod Ø38	38	2.06	1,134	10.24	5.387	9.5	●
Rod Ø40	40	2.29	1,257	12.57	6.283	10	●
Rod Ø50	50	3.57	1,963	30.68	12.27	12.5	●

Rods are also supplied as agriculture and horticulture stakes with agreed cut length, surface and end treatment; GFRP rebar for concrete is a separate, bar-specific product qualified to its own product standards (ASTM D7957, CSA S807, ISO 10406-1 test methods) and designed to ACI CODE-440.11 or CSA S806.

Flat bars

18 sizes

FIG. 9 Flat bar



Flat bars, W wide and T thick. I_x is the edgewise (strong) value about the axis parallel to T; I_y is flatwise. Used as stiffeners, splice and kick plates, wear strips and spacers.

Designation	W (mm)	T (mm)	Mass (kg/m)	A (mm²)	I_x (cm⁴)	W_x (cm³)	r_x (mm)	I_y (cm⁴)	W_y (cm³)	r_y (mm)	DXF
FB 12×3	12	3	0.07	36	0.0432	0.072	3.464	0.0027	0.018	0.866	●
FB 20×3	20	3	0.11	60	0.2	0.2	5.774	0.0045	0.03	0.866	●
FB 25×3	25	3	0.14	75	0.3906	0.3125	7.217	0.005625	0.0375	0.866	●
FB 25×5	25	5	0.23	125	0.651	0.5208	7.217	0.02604	0.1042	1.443	●
FB 30×4	30	4	0.22	120	0.9	0.6	8.66	0.016	0.08	1.155	●
FB 38×4.8	38	4.8	0.33	182.4	2.195	1.155	10.97	0.03502	0.1459	1.386	●
FB 50×5	50	5	0.45	250	5.208	2.083	14.43	0.05208	0.2083	1.443	●
FB 50×6	50	6	0.55	300	6.25	2.5	14.43	0.09	0.3	1.732	●
FB 50×10	50	10	0.91	500	10.42	4.167	14.43	0.4167	0.8333	2.887	●
FB 75×6	75	6	0.82	450	21.09	5.625	21.65	0.135	0.45	1.732	●
FB 75×10	75	10	1.36	750	35.16	9.375	21.65	0.625	1.25	2.887	●
FB 100×6	100	6	1.09	600	50	10	28.87	0.18	0.6	1.732	●
FB 100×10	100	10	1.82	1,000	83.33	16.67	28.87	0.8333	1.667	2.887	●
FB 100×15	100	15	2.73	1,500	125	25	28.87	2.813	3.75	4.33	●
FB 150×10	150	10	2.73	1,500	281.3	37.5	43.3	1.25	2.5	2.887	●
FB 150×15	150	15	4.09	2,250	421.9	56.25	43.3	4.219	5.625	4.33	●
FB 200×15	200	15	5.45	3,000	1,000	100	57.74	5.625	7.5	4.33	●
FB 305×25	305	25	13.86	7,625	5,911	387.6	88.05	39.71	31.77	7.217	●

Confirm flat-bar thickness, width, straightness and cut-length limits on the approved drawing and quotation. Thicker plate and sheet are a separate product with their own size list.

05 Allowable load tables

Maximum uniformly distributed service load, in kN/m, for every published I-beam, channel, square, rectangular and round tube over simple spans of 1 to 6 m, with the check that governs each value. The tables are the printed twin of the website span tables and are computed by the same code from the section data of Section 4 and the design basis of Section 3.

Design basis of every value

Material	EN 13706 Grade E23 (E-glass pultruded): E_L 23 GPa and shear strength 25 MPa (EN 13706 minimums), G_{LT} 3.5 GPa (assumed)
Strength	LRFD, ASCE/SEI 74-23 ($\phi = 0.65$, $\lambda = 0.8$ for occupancy live load, $\gamma_Q = 1.6$); design bending strength 88.4 MPa and shear 11.05 MPa after λ and the environment factor
Environment	Outdoor exposed (0.85 on strengths)
Load case	Simply supported, uniform distributed load, strong-axis bending
Deflection	L/250 at service load (Timoshenko shear deflection included)

How to read a value

Find the section and read across to the span: the value is the largest uniformly distributed *service* load the member carries with every check passing. The superscript marks the governing check: **d** deflection, **b** bending, **v** shear; a dash means below practical loading. 1 kN/m $\approx$ 68.5 lb/ft; a 1.2 m wide walkway at 5 kPa live load puts 6 kN/m on its pair of stringers, 3 kN/m on each.

Nearly every value is deflection-governed, the defining feature of fiberglass design. Shear governs only short, deep sections; bending rarely governs under L/250. For a different limit, a point load, a cantilever or another code, use the website calculator, which opens each row pre-loaded; for a member these tables cannot represent (angles, continuous spans, frames), send the case to engineering.

Not covered: local and lateral-torsional buckling, connections, concentrated loads, dynamic effects and long-term creep; review them to ASCE/SEI 74-23 or CEN/TS 19101. The values are a preliminary screen for comparing sections and preparing an inquiry, not a certified capacity.

I-beam span table

This FRP span table lists allowable uniform service loads for pultruded fiberglass I-beams and wide-flange beams used in walkways, platforms, and pipe racks. Compare the required clear span and load, then open the linked calculator to review the governing deflection, bending, or shear check.

Section	kg/m	I_x (cm ⁴)	1 m	1.5 m	2 m	2.5 m	3 m	4 m	5 m	6 m
I 76×38×6.4	1.2	72.53	4.6 ^d	1.4 ^d	0.62 ^d	0.32 ^d	0.19 ^d	0.08 ^d	—	—
I 100×50×6	1.6	166.8	7.3 ^v	3.2 ^d	1.4 ^d	0.73 ^d	0.43 ^d	0.18 ^d	0.09 ^d	0.05 ^d
I 120×60×6	2	297.1	9.0 ^v	5.5 ^d	2.4 ^d	1.3 ^d	0.75 ^d	0.32 ^d	0.17 ^d	0.10 ^d
I 152×76×6.4	2.9	659.8	12.3 ^v	8.2 ^v	5.2 ^d	2.8 ^d	1.6 ^d	0.71 ^d	0.37 ^d	0.21 ^d
I 160×80×8	3.6	939.1	15.9 ^v	10.6 ^v	7.3 ^d	3.9 ^d	2.3 ^d	1.0 ^d	0.52 ^d	0.30 ^d
I 200×100×10	5.8	2,293	24.9 ^v	16.6 ^v	12.4 ^v	9.2 ^d	5.5 ^d	2.4 ^d	1.3 ^d	0.73 ^d
I 240×120×12	8.4	4,754	35.8 ^v	23.9 ^v	17.9 ^v	14.3 ^v	11.0 ^d	4.9 ^d	2.6 ^d	1.5 ^d
I 300×150×15	13.5	11,610	55.9 ^v	37.3 ^v	28.0 ^v	22.4 ^v	18.6 ^v	11.5 ^d	6.1 ^d	3.6 ^d
I 305×305×12.7	16	18,870	49.0 ^v	32.7 ^v	24.5 ^v	19.6 ^v	16.3 ^v	12.3 ^v	9.4 ^d	5.6 ^d

Channel span table

19 sizes · service UDL in kN/m · d deflection, b bending, v shear

This FRP channel span table gives allowable uniform service loads for pultruded fiberglass U-profiles commonly used as stringers, cable-tray supports, and frame rails. Values use the design basis stated above; follow the calculator link when connection behavior, concentrated loads, or a different exposure condition governs.

Section	kg/m	I _x (cm ⁴)	1 m	1.5 m	2 m	2.5 m	3 m	4 m	5 m	6 m
U 38×13×4.8	0.4	4.379	0.30 ^d	0.09 ^d	—	—	—	—	—	—
U 50×25×5	0.7	15.38	1.0 ^d	0.32 ^d	0.13 ^d	0.07 ^d	—	—	—	—
U 76×25×6.4	1	52.33	3.4 ^d	1.1 ^d	0.45 ^d	0.23 ^d	0.14 ^d	0.06 ^d	—	—
U 76×38×6.4	1.4	72.53	4.6 ^d	1.4 ^d	0.62 ^d	0.32 ^d	0.19 ^d	0.08 ^d	—	—
U 100×30×6	1.5	113.7	7.1 ^d	2.2 ^d	0.97 ^d	0.50 ^d	0.29 ^d	0.12 ^d	0.06 ^d	—
U 100×50×6	1.8	166.8	7.3 ^v	3.2 ^d	1.4 ^d	0.73 ^d	0.43 ^d	0.18 ^d	0.09 ^d	0.05 ^d
U 120×50×6	2	258.1	9.0 ^v	4.9 ^d	2.1 ^d	1.1 ^d	0.66 ^d	0.28 ^d	0.14 ^d	0.08 ^d
U 150×40×6	2.1	380.4	11.4 ^v	7.1 ^d	3.1 ^d	1.6 ^d	0.96 ^d	0.41 ^d	0.21 ^d	0.12 ^d
U 152×43×6.4	2.2	435.7	12.3 ^v	8.0 ^d	3.6 ^d	1.9 ^d	1.1 ^d	0.47 ^d	0.24 ^d	0.14 ^d
U 152×43×9.5	3.2	601.6	17.5 ^v	11.1 ^d	4.9 ^d	2.6 ^d	1.5 ^d	0.65 ^d	0.34 ^d	0.20 ^d
U 160×48×8	3	643.1	15.9 ^v	10.6 ^v	5.2 ^d	2.8 ^d	1.6 ^d	0.69 ^d	0.36 ^d	0.21 ^d
U 200×60×8	3.8	1,301	20.3 ^v	13.6 ^v	10.1 ^d	5.4 ^d	3.2 ^d	1.4 ^d	0.72 ^d	0.42 ^d
U 200×60×10	4.6	1,570	24.9 ^v	16.6 ^v	12.2 ^d	6.5 ^d	3.9 ^d	1.7 ^d	0.87 ^d	0.51 ^d
U 240×72×8	4.6	2,300	24.8 ^v	16.5 ^v	12.4 ^v	9.2 ^d	5.5 ^d	2.4 ^d	1.3 ^d	0.74 ^d
U 240×72×12	6.8	3,256	35.8 ^v	23.9 ^v	17.9 ^v	13.1 ^d	7.8 ^d	3.4 ^d	1.8 ^d	1.0 ^d
U 254×76×9.5	5.6	3,187	30.8 ^v	20.6 ^v	15.4 ^v	12.3 ^v	7.6 ^d	3.3 ^d	1.7 ^d	1.0 ^d
U 300×90×15	10.4	7,948	55.9 ^v	37.3 ^v	28.0 ^v	22.4 ^v	18.3 ^d	8.1 ^d	4.3 ^d	2.5 ^d
U 305×89×12.7	8.8	7,145	49.0 ^v	32.7 ^v	24.5 ^v	19.6 ^v	16.3 ^v	7.3 ^d	3.8 ^d	2.3 ^d
U 360×108×18	15	16,480	80.6 ^v	53.7 ^v	40.3 ^v	32.2 ^v	26.9 ^v	16.4 ^d	8.7 ^d	5.1 ^d

Square and rectangular tube span table

20 sizes · service UDL in kN/m · d deflection, b bending, v shear

This FRP span table covers pultruded fiberglass square and rectangular hollow sections used for solar purlins, guardrail posts, and light framing. The values represent simply supported strong-axis members under uniform load, so designers should separately check local attachment forces, post action, and project-specific load cases.

Section	kg/m	I _x (cm ⁴)	1 m	1.5 m	2 m	2.5 m	3 m	4 m	5 m	6 m
SHS 25×25×3.2	0.4	2.258	0.16 ^d	—	—	—	—	—	—	—
SHS 38×38×4.8	0.9	11.95	0.82 ^d	0.25 ^d	0.10 ^d	0.05 ^d	—	—	—	—
RHS 40×20×7	1	9.788	0.68 ^d	0.20 ^d	0.09 ^d	—	—	—	—	—
RHS 40×25×8	1.2	12.3	0.85 ^d	0.26 ^d	0.11 ^d	0.06 ^d	—	—	—	—
SHS 50×50×5	1.4	30.75	2.1 ^d	0.63 ^d	0.27 ^d	0.14 ^d	0.08 ^d	—	—	—
SHS 60×60×5	1.7	55.92	3.7 ^d	1.1 ^d	0.49 ^d	0.25 ^d	0.15 ^d	0.06 ^d	—	—
SHS 75×75×6	2.5	132.4	8.4 ^d	2.6 ^d	1.1 ^d	0.59 ^d	0.34 ^d	0.15 ^d	0.07 ^d	—
RHS 80×60×5	2	113.1	7.3 ^d	2.3 ^d	0.97 ^d	0.50 ^d	0.29 ^d	0.12 ^d	0.06 ^d	—
SHS 100×100×6	3.5	333.6	14.6 ^v	6.4 ^d	2.8 ^d	1.5 ^d	0.85 ^d	0.36 ^d	0.19 ^d	0.11 ^d
SHS 100×100×8	4.5	418.4	18.6 ^v	8.1 ^d	3.5 ^d	1.8 ^d	1.1 ^d	0.46 ^d	0.23 ^d	0.14 ^d
RHS 100×60×8	3.6	282.7	17.6 ^d	5.6 ^d	2.4 ^d	1.3 ^d	0.73 ^d	0.31 ^d	0.16 ^d	0.09 ^d
SHS 114×114×6	4	505.4	16.9 ^v	9.5 ^d	4.2 ^d	2.2 ^d	1.3 ^d	0.55 ^d	0.28 ^d	0.16 ^d
SHS 114×114×8	5.2	638.8	21.7 ^v	12.0 ^d	5.3 ^d	2.8 ^d	1.6 ^d	0.69 ^d	0.36 ^d	0.21 ^d
SHS 120×120×8	5.6	753.1	23.0 ^v	14.0 ^d	6.2 ^d	3.3 ^d	1.9 ^d	0.82 ^d	0.42 ^d	0.24 ^d
RHS 120×60×5	2.6	309.4	15.2 ^v	6.0 ^d	2.6 ^d	1.4 ^d	0.79 ^d	0.34 ^d	0.17 ^d	0.10 ^d
SHS 132×132×9.5	7	1,171	29.7 ^v	19.8 ^v	9.5 ^d	5.0 ^d	3.0 ^d	1.3 ^d	0.65 ^d	0.38 ^d
SHS 152×152×9.5	8.2	1,841	34.9 ^v	23.3 ^v	14.6 ^d	7.8 ^d	4.6 ^d	2.0 ^d	1.0 ^d	0.59 ^d
SHS 160×160×8	7.4	1,878	31.8 ^v	21.2 ^v	14.7 ^d	7.8 ^d	4.6 ^d	2.0 ^d	1.0 ^d	0.61 ^d
SHS 200×200×10	11.6	4,585	49.7 ^v	33.1 ^v	24.9 ^v	18.4 ^d	11.0 ^d	4.8 ^d	2.5 ^d	1.5 ^d
SHS 240×240×12	16.8	9,508	71.6 ^v	47.7 ^v	35.8 ^v	28.6 ^v	22.0 ^d	9.8 ^d	5.1 ^d	3.0 ^d

Rectangular tubes are tabulated in the deep orientation (H vertical). A tube used as a guardrail post is a cantilever under a horizontal load and is checked in Section 6, not here.

Round tube span table

17 sizes · service UDL in kN/m · d deflection, b bending, v shear

This FRP round-tube span table provides allowable uniform service loads for pultruded fiberglass circular hollow sections used as handrails, cross-members, and light spanning members. Select the diameter and wall thickness, compare the clear span, and verify the result in the calculator before final project specification.

Section	kg/m	I _x (cm ⁴)	1 m	1.5 m	2 m	2.5 m	3 m	4 m	5 m	6 m
CHS 25×3	0.3	1.278	0.09 ^d	—	—	—	—	—	—	—
CHS 32×3	0.4	2.904	0.20 ^d	0.06 ^d	—	—	—	—	—	—
CHS 38×3.2	0.5	5.341	0.37 ^d	0.11 ^d	—	—	—	—	—	—
CHS 42×4	0.7	8.715	0.60 ^d	0.18 ^d	0.08 ^d	—	—	—	—	—
CHS 50×4	0.9	15.41	1.1 ^d	0.32 ^d	0.13 ^d	0.07 ^d	—	—	—	—
CHS 50×5	1.1	18.11	1.2 ^d	0.37 ^d	0.16 ^d	0.08 ^d	—	—	—	—
CHS 60×5	1.3	32.94	2.2 ^d	0.68 ^d	0.29 ^d	0.15 ^d	0.09 ^d	—	—	—
CHS 63.5×6.4	1.7	47.38	3.2 ^d	0.97 ^d	0.41 ^d	0.21 ^d	0.12 ^d	0.05 ^d	—	—
CHS 70×5	1.6	54.24	3.6 ^d	1.1 ^d	0.47 ^d	0.24 ^d	0.14 ^d	0.06 ^d	—	—
CHS 76×6.4	2.1	85.45	5.6 ^d	1.7 ^d	0.74 ^d	0.38 ^d	0.22 ^d	0.09 ^d	—	—
CHS 80×5	1.8	83.2	5.4 ^d	1.7 ^d	0.72 ^d	0.37 ^d	0.22 ^d	0.09 ^d	—	—
CHS 80×7	2.5	107.9	7.0 ^d	2.2 ^d	0.93 ^d	0.48 ^d	0.28 ^d	0.12 ^d	0.06 ^d	—
CHS 89×6.4	2.5	142.5	9.1 ^d	2.8 ^d	1.2 ^d	0.63 ^d	0.37 ^d	0.16 ^d	0.08 ^d	—
CHS 100×6	2.7	196.5	12.2 ^d	3.9 ^d	1.7 ^d	0.87 ^d	0.51 ^d	0.22 ^d	0.11 ^d	0.06 ^d
CHS 114×6.4	3.3	314.2	14.9 ^v	6.1 ^d	2.7 ^d	1.4 ^d	0.81 ^d	0.34 ^d	0.18 ^d	0.10 ^d
CHS 127×6.4	3.7	442.1	16.7 ^v	8.4 ^d	3.7 ^d	1.9 ^d	1.1 ^d	0.48 ^d	0.25 ^d	0.14 ^d
CHS 150×8	5.4	902.4	24.6 ^v	16.4 ^v	7.4 ^d	3.9 ^d	2.3 ^d	0.98 ^d	0.50 ^d	0.29 ^d

06

Applications and systems

Which profile family carries which job, the application guides published on the website in condensed form, and the handrail and ladder systems assembled from catalog sections with the load cases they are checked against. An application page writes "what profile, which resin, which standards"; the industries table below describes who buys and why.

Selection matrix

A mark means the application guide recommends the family. Custom pultrusions (brackets, strut, tray sections, crossarm profiles) appear in most guides and are not shown.

Application	I-beam	Channel	Angle	Square tube	Rectangular tube	Round tube	Rod	Flat bar	Resin the guide names first
FRP cable trays & ladders		●	●	●					Isophthalic polyester
FRP utility crossarms				●	●				Per exposure
FRP cooling tower profiles	●	●	●	●					Vinyl ester
FRP bridge deck panels	●	●							Isophthalic polyester
FRP solar mounting profiles		●	●	●				●	UV-stabilized
FRP chemical plant platforms	●	●	●	●		●		●	Vinyl ester
FRP pedestrian bridge superstructures	●	●		●					Vinyl ester

Industries served

Industry	Typical scope
Buildings & Construction	Lightweight, corrosion-resistant structural profiles for modern building envelopes and facades.
Infrastructure	Durable FRP solutions for bridges, walkways, and civil engineering structures.
Energy & Power	Dielectric, UV-resistant FRP profiles for substations, transmission, renewables, and power infrastructure.
Marine & Offshore	Saltwater-resistant grating, decking and profiles for docks, marinas, boardwalks and offshore access.
Industrial & Chemical	Pultruded structural profiles for processing plants and manufacturing facilities.
Automotive & Rail	Pultruded profiles to evaluate for passenger cars, buses, EV battery enclosures, commercial bodies and selected rail components.
Water & Wastewater	Profiles and grating for cable supports, access frames and walking surfaces around treatment equipment.

Project references

CASE STUDY

Factory access staircase

A bolted FRP stair in our Chongqing plant, assembled by four people with hand tools: no welding, hot work or crane.

CASE STUDY

Chongqing rooftop PV retrofit

Pultruded GFRP H-rail on color steel-tile factory roofs, with about 75% less rail dead load than galvanized steel.

DESIGN GUIDE

Beam bridge design

Load paths, width, vibration and FRP detailing for pedestrian and cycle bridges, with three source-backed case studies.

Each reference is documented on the website with project photographs or the design drawings; sizes, resins and connections are project-specific and are not transferable without design.

Application guides

Condensed from the website guides; each names the profiles, resin, standards and checks that apply

FRP cable trays & ladders

Substations, tunnels, wastewater plants, chemical plants and coastal utilities evaluating composite cable-route supports. Electrical isolation, fire behavior and site installation requirements need separate project review.

PROFILES

- Channel sections for tray stringers and wall-mounted supports
- Angles for cleats, ledgers, and bracing
- Square tube for posts and free-standing frames
- Custom pultruded brackets and fiberglass strut for repeat modular assemblies

RESIN

Evaluate isophthalic polyester or vinyl ester against the actual chemicals, concentrations, temperature and exposure duration. State fire, smoke and toxicity requirements separately and confirm evidence for the offered resin and system.

STANDARDS

IEC 61537 · system scope · UL 568 · nonmetallic trays · EN 13706 · profiles

DESIGN CHECKS

- **Support spacing and serviceability.** Size channels and brackets from the loaded tray span, not from tray width alone. Cable mass, future fill allowance, splice position, and the project deflection limit all affect the support spacing.
- **Fire and electrical scope.** Confirm flame-spread, smoke and electrical requirements for the offered material and route. A fiberglass support is not proof of a qualified insulating system; metallic hardware, bonding, static control and lightning protection remain part of the electrical engineer's design.
- **Connections and local loads.** Wall brackets, post bases, and tray clamps introduce bearing and pull-out loads that are not represented by a simple beam-span check. State hole patterns and edge distances before fabrication release.

FRP utility crossarms

Overhead distribution pole replacements, new lines and coastal or humid networks where a qualified composite crossarm may reduce exposure to timber decay or steel corrosion.

PROFILES

- Pultruded rectangular or square hollow crossarm profile to an approved drawing
- Factory-cut and drilled members with specified end treatment
- Braces, mounts and hardware only when included in the agreed supply scope

RESIN

Specify the actual glass reinforcement, resin, surface protection, moisture control and cut-edge treatment for the site. Request electrical and weathering evidence for the offered laminate and assembly; a material name is not a voltage rating.

STANDARDS

ASTM D8019 · assembled flexure · ASTM D2303 · tracking and erosion · ASTM G154 · UV exposure · Utility / local line code

DESIGN CHECKS

- **Phase and line loads.** Check vertical weight and ice, transverse wind and angle loads, and longitudinal loads at dead ends or broken-wire cases as required by the utility.
- **Complete connection.** Verify bending and deflection with the actual pole mount, braces, drilled holes, local bearing, fasteners and insulator hardware.
- **Electrical and weathering.** Coordinate phase-to-phase and phase-to-ground clearances, wet or contaminated surface behavior, UV exposure and water ingress at ends and holes.

Application guides, continued

FRP cooling tower profiles

Best fit: industrial cooling towers, power plant cooling systems, HVAC towers, chemical plants, and replacement programs where steel members require repeated recoating.

PROFILES

- I-beams and channels for primary support members
- Square tubes for frames, posts, and bracing
- Angles for edge supports and louver framing
- Custom louver or casing-support sections subject to drawing and tooling review

RESIN

Compare the offered polyester or vinyl ester formulation against operating temperature, pH, chemical concentrations, biocide dosing and cleaning cycles. Confirm the relevant exposure evidence and surface / cut-edge treatment; a resin name alone does not establish service life.

STANDARDS

EN 13706 · ASTM D3917 · ASTM D638 · ASTM D790

DESIGN CHECKS

- **Water chemistry and temperature.** Provide chloride concentration, pH, biocide program, operating temperature, and cleaning chemicals. Resin selection must be checked against the combined exposure rather than against humidity alone.
- **Buckling and sustained load.** Columns, diagonal braces, and fan-deck members require global and local buckling checks. Permanent equipment and casing loads also require the applicable long-duration design factors.
- **Connections in saturated service.** Connection plates, bolt bearing, drainage details, and cut-edge sealing need to be coordinated so trapped water and repeated wet-dry cycling do not create avoidable local damage.

FRP bridge deck panels

Best fit: pedestrian bridges, coastal boardwalks, utility access decks, replacement decks on aging structures, and projects where a lighter deck reduces crane size or substructure reinforcement.

PROFILES

- Closed-top deck panels for continuous walking surfaces
- Pultruded gratings for drainage and ventilation
- I-beams and channels for secondary support framing
- Custom edge profiles and splice plates for modular panels

RESIN

Isophthalic polyester is common for general infrastructure. Vinyl ester is recommended for coastal, de-icing salt, marine, wastewater, and chemical exposure. Gritted top surfaces are used for pedestrian slip resistance.

STANDARDS

EN 13706 · ASTM D3917 · AASHTO load classes · AS 4586

DESIGN CHECKS

- **Panel span and load distribution.** State the clear support spacing, deck orientation, pedestrian or vehicle load model, wheel or patch loads, and the required deflection limit. Adjacent-plank load sharing must be justified by the joint detail.
- **Surface and drainage.** Select a gritted anti-slip surface, closed or open deck, crossfall, drainage path, and joint geometry from the access and climate requirements. Public routes may also impose opening and accessibility limits.
- **Deck-to-girder connection.** Clips, through-bolts, adhesive interfaces, edge distances, and thermal movement define how panel reactions reach the supporting girders. The deck cannot be specified independently of this connection zone.

Application guides, continued

FRP solar mounting profiles

Best fit: coastal solar farms, floating PV, agricultural PV, corrosive industrial sites, and off-grid structures where weight reduction simplifies transport and installation.

PROFILES

- Channels and square tubes for rails and posts
- Angles for panel support brackets and bracing
- Flat bars and custom sections for clips, spacers, and edge members
- Vinyl ester or UV-stabilized polyester laminates for harsh outdoor service

RESIN

UV-stabilized isophthalic polyester is the baseline for standard outdoor PV supports. Vinyl ester is recommended for coastal, floating PV, fertilizer exposure, and aggressive industrial environments.

STANDARDS

EN 13706 · ASTM D3917 · ASTM D638 · ASTM D790

DESIGN CHECKS

- **Wind, snow, and array geometry.** Rail and post sizing starts with module dimensions, support points, tributary area, uplift and downward wind pressure, snow drift, seismic demand, and the project's serviceability limit.
- **Roof or foundation interface.** Standing-seam clamps, roof fasteners, piles, ballast, and floating supports each create different local reactions. Pull-out and attachment capacity must be checked separately from the FRP rail span.
- **Electrical and environmental coordination.** FRP rails do not create a conductive path, but modules, inverters, metallic clips, cabling, and lightning protection still require code-compliant bonding. Coastal, fertilizer, floating, and desert sites also need different resin and UV packages.

FRP chemical plant platforms

Best fit: acid production, fertilizer plants, chlor-alkali units, wastewater treatment, battery materials, petrochemical areas, and any process zone where coating maintenance is expensive or unsafe.

PROFILES

- FRP I-beams and channels for primary and secondary framing
- Molded or pultruded FRP gratings for walking surfaces
- FRP round tubes and square tubes for handrails and guardrails
- FRP angles and flat bars for bracing, toe boards, and splice plates

RESIN

Select from the offered formulations using chemical concentration, temperature, splash or immersion, and cleaning conditions. Vinyl ester may be considered, but resin name alone does not establish compatibility. Confirm the availability of any required flame, smoke or other safety evidence for the actual product and assembly.

STANDARDS

EN 13706 · ASTM D3917 · ASTM E84 · BS 476

DESIGN CHECKS

- **Chemical compatibility.** List each chemical, concentration, temperature, exposure mode, and cleaning cycle. Resin selection should reflect the worst credible combined service condition and any required verification testing.
- **Platform load path.** Check primary beams, secondary members, grating spans, stair stringers, handrail posts, base plates, and connections as one assembly under operating, maintenance, and equipment loads.
- **Fire and plant safety.** Corrosion resistance does not establish fire performance. Confirm flame, smoke, electrical, anti-slip, egress, and static-control requirements for the actual process area before selecting the laminate and surface.

Application guides, continued

FRP pedestrian bridge superstructures

Best fit: coastal and riverside crossings, park and trail bridges, utility access bridges, replacement superstructures on retained abutments, and remote sites where smaller lifts and prefabricated modules reduce construction disruption.

PROFILES

- I-beams, channels, or box members for primary longitudinal girders
- Square tubes and custom closed sections for trusses and cross-bracing
- Closed-top deck panels or pultruded grating for the walking surface
- Round and square tubes for parapets, handrails, and approach guards

RESIN

Specify the resin, reinforcement, protective surface and service temperature together. Compare polyester and vinyl ester systems using supplier data for the actual wet, salt or chemical exposure; resin name alone does not establish durability. Request the relevant retained-property and weathering evidence. Fire and smoke criteria need separate review for enclosed crossings or egress routes.

STANDARDS

Owner-adopted pedestrian bridge criteria · ASCE/SEI 74-23 where applicable · Project-specific deck slip testing

DESIGN CHECKS

- **Global stiffness and vibration.** Primary members require strength, deflection, buckling, and pedestrian vibration checks under the governing load combinations. FRP bridges are commonly serviceability-controlled.
- **Joints and module boundaries.** Bolted, bonded, or hybrid splices must transfer girder, truss, deck, and parapet actions while remaining inspectable. Transport length and lift planning often determine where those joints belong.
- **Interfaces and local approvals.** Bearings, abutments, foundations, accessibility, drainage, anti-slip surface, parapet loads, and owner-specific bridge criteria remain part of the local engineer's complete design.

What each guide asks for in an inquiry

Application	Inquiry inputs
FRP cable trays & ladders	Supply scope: support profiles, fabricated components or a complete tray / ladder package · Route drawing and BOM: widths, depths, straight lengths, bends, tees, covers and splice positions · Support spacing, cable load per meter, future fill allowance and concentrated loads · Chemical, humidity, UV, and temperature exposure · Governing specification, acceptance criteria and required load, fire or electrical evidence · Bracket / base details, fixing substrate, quantity, delivery destination and required date
FRP utility crossarms	Utility standard drawing and pole arrangement · Voltage class, conductor / insulator layout and clearances · Load cases and required serviceability limits · Crossarm section, length, hole schedule and connection details · Resin, UV, electrical and test-document requirements · Quantity, destination and requested supply scope
FRP cooling tower profiles	Task: existing-member replacement, new-tower OEM supply or maintenance access · Cooling tower type and operating temperature range · Water chemistry: chlorides, pH, biocides, and chemical dosing · Member schedule, spans, load cases, deflection limits and connection reactions · Existing survey or released OEM drawings, hole patterns, interfaces and revision · Supply quantities, surface / fire requirements, acceptance documents and delivery or outage date
FRP bridge deck panels	Clear span, support spacing, and required deck width · Pedestrian, maintenance vehicle, or light vehicular load class · Required deflection limit and anti-slip surface · Exposure: coastal, de-icing salt, UV, chemicals, or immersion · Panel length limits for container loading and installation access
FRP solar mounting profiles	PV module size, array layout, and support spacing · Wind, snow, and seismic design loads · Site exposure: coastal, desert, agricultural, floating, or industrial · Grounding, bonding, and electrical isolation requirements · Target service life and UV/color requirements
FRP chemical plant platforms	Scope: grating replacement, component supply or a coordinated platform / walkway package · Chemical exposure list, concentration, temperature, and spill frequency · Layout, elevations, spans, operating / maintenance loads and deflection limits · Grating type, span direction, bearing, cutouts, fixings and retained support condition · Fire, smoke, and plant safety requirements · Component BOM, connection / anchor responsibility, required acceptance documents and destination
FRP pedestrian bridge superstructures	Clear span, deck width, alignment, and available structural depth · Pedestrian density, maintenance vehicle, wind, snow, and seismic actions · Deflection, vibration, parapet, accessibility, and anti-slip criteria · Site exposure, design life, drainage, and fire requirements · Transport route, maximum module size, crane or manual-lift constraints

Handrail and guardrail systems

Catalog assemblies in handrail-system tube sizes (wall thicknesses differ from Section 4); the post is a cantilever under the code load

Square-tube FRP handrail system

A rectilinear post-and-rail arrangement with internal splices, kick plate, corner fittings and an optional base detail.

Item	Catalog value
Post spacing	1,500 mm maximum
Handrail height	1,220 mm maximum
Top rail	Square tube 50 × 50 × 6.4 mm
Middle rail	Square tube 50 × 50 × 6.4 mm
Insert splice	Square tube 38 × 38 × 6.4 mm
Kick plate	100 × 14 × 3 mm
Kick-plate splice plate	45 mm wide × 101 mm long × 6 mm thick
90° kick-plate splice angle	54 × 29 × 6.4 mm
90° handrail fitting	3 × FRP angles, 152 × 152 × 13 mm; 38 mm long
Adjustable fitting	Plastic fitting, 39°–180°
Catalog connection rivet	4 × 20 mm

F1's catalog drawing and parts list differ on part of the middle-rail geometry; the approved project BOM and connection drawing govern the released assembly.

How a post-and-rail system is checked

The post is a cantilever fixed at its base plate under the horizontal rail load; the top rail spans simply between posts, which is conservative for a continuous rail. The line load and the concentrated load are separate cases, as the codes apply them. The check compares the post bending stress at the base and the rail stress at mid-span with the design strengths of Section 3, reports the horizontal deflection at the hand rail and the anchor-bolt reactions, and gives the characteristic (unfactored) capacity beside the design capacity so that a test load can be compared with it. The load cases are on the next page.

Verify the post, not just the rail. Screening the square system's 50 × 50 × 6.4 mm tube as the post at 1,067 mm under the OSHA 200 lb load with the ASCE factors gives a utilization above 100 percent, so a project relies on a whole-assembly load test or a project-specific post and base design, which F1 prepares with the handrail load calculator on the website. The installed rail height comes from the rule, not from the catalog maximum: the catalog's 1,220 mm exceeds the 1,143 mm (45 in) OSHA maximum, so a US system is built lower. Under the downward 200 lb load the OSHA rail must stay at or above 991 mm; EN ISO 14122-3 limits the horizontal deflection to 30 mm under 300 N/m × post spacing.

Round-tube FRP handrail system

A round post-and-rail arrangement using molded elbow, tee, cross and foot-base fittings with a separate kick plate.

Item	Catalog value
Post spacing	1,500 mm maximum
Handrail height	1,220 mm maximum
Post	Round tube 50 × 5 mm (catalog notation)
Top rail	Round tube 50 × 5 mm (catalog notation)
Middle rail	Round tube 50 × 5 mm (catalog notation)
Kick plate	101 × 14 × 3 mm
Fittings	BMC elbow, tee, cross and foot base
Catalog fitting screws	M5 × 55; elbow 2, tee 2, cross 3
Catalog foot-base anchors	M6 × 90; two per foot base

The catalog's kick-plate splice length is not reproduced here; final splice size, fastener material and anchorage come from the approved project drawing.

Guardrail load cases

The rules the handrail systems are checked against

Region	Rule	Clause	Line load (kN/m)	Concentrated (kN)	Rail height (mm)
US	IBC 2024 guards, general	IBC 2024 §1607.9.1 and §1015.3; ASCE 7-22 §4.5.1	0.73	0.89	1,067 min
US	IBC 2024 guards, non-public industrial area	IBC 2024 §1607.9.1 Exception 2	0.29	0.89	1,067 min
US	OSHA 1910.29 guardrail (general industry)	29 CFR 1910.29(b)(1)–(5)	—	0.89	991–1,143
EU	EN ISO 14122-3 guardrail (machinery access)	EN ISO 14122-3:2016	—	0.3 × spacing	1,100 min
UK	BS EN ISO 14122-3 guardrail (machinery access)	BS EN ISO 14122-3:2016	—	0.3 × spacing	1,100 min
UK	UK industrial or storage area, not prone to overcrowding	BS 6180:2011 Table 2; BS EN 1991-1-1 UK National Annex, Table NA.8	0.74	0	per clause
UK	UK light pedestrian route in an industrial building	BS 6180:2011 Table 2; BS EN 1991-1-1 UK National Annex, Table NA.8	0.36	0	per clause
CA	Canada: access to equipment platforms	NBC 2020 Division B, Article 4.1.5.14 (or the provincial code in force)	—	1	per clause
CA	Canada: guards in other locations	NBC 2020 Division B, Article 4.1.5.14 (or the provincial code in force)	0.75	1	per clause
AU	Australia: AS 1657 platforms, walkways and stairways	AS 1657:2018 (guardrailing); AS/NZS 1170.1 Table 3.3 row for fixed access	0.35	0.6	900–1,100
AU	Australia: offices and work areas	AS/NZS 1170.1 Table 3.3 (occupancy types B and E)	0.75	0.6	per clause
NZ	New Zealand: offices and work areas	AS/NZS 1170.1 Table 3.3 (occupancy types B and E) through NZBC B1; barrier geometry under NZBC F4	0.75	0.6	per clause

Notes by rule

Rule	Note (the first of each rule; the website tool lists all)
IBC 2024 guards, general	50 lb/ft (0.73 kN/m) and 200 lb (0.89 kN) in any direction, not applied together.
IBC 2024 guards, non-public industrial area	20 lb/ft (0.29 kN/m) in Group I-3, F, H and S areas not accessible to the general public with an occupant load under 50.
OSHA 1910.29 guardrail (general industry)	Top edge 42 in (1,067 mm) ± 3 in; 200 lb (890 N) outward or downward within 2 in of the top edge, at any point.
EN ISO 14122-3 guardrail (machinery access)	Test load $F = 300 \text{ N/m} \times \text{post spacing}$ at the most unfavorable point; deflection no more than 30 mm.
BS EN ISO 14122-3 guardrail (machinery access)	Same requirements as EN ISO 14122-3 for permanent access to machinery.
UK industrial or storage area, not prone to overcrowding	0.74 kN/m at the top. The infill takes 1.0 kN/m ² or 0.5 kN on any part as separate cases, which this tool does not check.
UK light pedestrian route in an industrial building	0.36 kN/m for light pedestrian traffic routes in industrial and storage buildings, except designated escape routes. Infill 0.5 kN/m ² or 0.25 kN.
Canada: access to equipment platforms	1.0 kN concentrated at any point, for access ways to equipment platforms, contiguous stairs and similar areas where the gathering of many people is improbable.
Canada: guards in other locations	0.75 kN/m or 1.0 kN concentrated at any point, whichever governs. Individual infill elements take 0.5 kN over 100 × 100 mm.
Australia: AS 1657 platforms, walkways and stairways	600 N at any point of the top rail, intermediate rail or post, or 350 N/m along a rail, outward or downward; elastic deflection no more than 100 mm.
Australia: offices and work areas	0.75 kN/m horizontal or 0.6 kN concentrated at the top edge, as separate cases; infill 1.0 kPa or 0.5 kN.
New Zealand: offices and work areas	0.75 kN/m horizontal or 0.6 kN concentrated at the top edge, as separate cases; infill 1.0 kPa or 0.5 kN.

The US and EN ISO 14122-3 rows were checked against the rule text or secondary sources that agree; the UK, Canadian and Australian rows were checked against secondary sources only and say so on the website tool. Verify against the current edition before a compliance statement. Each region also offers a "manual entry" case on the website for categories not listed here.

Fixed ladders and access geometry

Catalog fixed ladder

Item	Catalog value
Maximum length without a splice	7,300 mm
Maximum ladder length with catalog cage	10,200 mm
Outside width, rail to rail	500 mm
Rung spacing, center to center	300 mm
Fluted round-tube rung	32 mm outside diameter × 6.4 mm wall
Square-tube side rail / post	50.8 × 50.8 × 6.4 mm
Solid square splice bar	38 × 38 mm × 200 mm long
Rung gasket	Black rubber
Catalog rung-to-rail rivet	4 × 20 mm

Cage layout references

Item	Catalog value
Equal hoop spacing	1,219 mm maximum
Wall-bracket spacing	1,829 mm maximum
Bottom-of-cage clearance	2,100 mm minimum / 2,400 mm maximum
Front cage width	813 mm
Walk-through side clear dimension	400 mm ID
Top-rung transition	Top rung level with walkout surface
Catalog platform-height reference	9,144 mm maximum

Check the clear width on the drawing. The catalog lists an outside width of 500 mm rail to rail with 50.8 mm rails, which leaves about 398 mm clear, below the 406 mm (16 in) of OSHA 1910.23 and the 400 mm of EN ISO 14122-4. Confirm which dimension the 500 mm controls before release; if it is the outside width, the ladder is widened for the project. In the United States a new fixed ladder over 24 ft (7.3 m) needs a ladder safety or personal fall-arrest system; a cage alone no longer satisfies OSHA.

Access rules the geometry is checked against

Element	United States	Europe and United Kingdom	Australia
Fixed ladders	OSHA 1910.23 and 1910.28(b)(9)	EN ISO 14122-4:2016	AS 1657:2018: rungs 250–300 mm, 375–525 mm between stiles, 200 mm behind rungs
Stairs	OSHA 1910.25 standard and ship stairs; IBC 2024 §1011	EN ISO 14122-3:2016	AS 1657: 20–45°, risers 130–225 mm, goings 215–355 mm, 2R + G 540–700 mm, ≤ 18 risers per flight
Walkways and platforms	ASCE 7-22 Table 4.3-1 loads; OSHA 1910 Subpart D	EN ISO 14122-2:2016	AS 1657: headroom ≥ 2,000 mm; AS/NZS 1170.1 loads
Guard rails	OSHA 1910.29; IBC 2024 §1607.9.1	EN ISO 14122-3: 1,100 mm, 300 N/m × spacing, 30 mm	AS 1657: 900–1,100 mm; 0.35 kN/m or 0.6 kN

The Australian and some European values were checked against secondary sources only; verify them against the current edition before a compliance statement. Canadian provincial ladder rules differ by province. The website access-geometry checker applies these rules to a proposed layout.

07

Durability: chemical, fire, weathering and temperature

Durability belongs to the cured laminate in its exposure, not to fiberglass as a category. This section says how F1 states each property, what evidence exists today, and what a specification has to ask for. No universal service life or maintenance interval applies to the catalog: design life depends on the material system, loads, exposure, connections and the inspection plan agreed for the project.

Chemical resistance

Build the compatibility decision around the chemical, its concentration, the temperature and the contact mode (immersion, splash or vapor). Resin-family charts are useful for screening; the exact cured laminate determines the offered performance, so F1 confirms compatibility for the proposed application rather than publishing a blanket table. The matrix sets the resistance: isophthalic polyester for general atmospheric and mild chemical service, vinyl ester for acids, chlorides, caustics,

immersion and marine splash, with a surface veil in either case, because the barrier is the veil-plus-resin skin rather than the structural core.

Four examples that show the role of resin and temperature.

From a published supplier comparison of isophthalic polyester and vinyl ester laminates at 20 °C and 50 °C (NHC · Chemical resistance) [REFERENCE](#).

Duration, stress and the exact laminate are not stated in the source; the rows are not a project approval.

Chemical	Isophthalic polyester, 20 °C	Isophthalic polyester, 50 °C	Vinyl ester, 20 °C	Vinyl ester, 50 °C
Hydrochloric acid · 20%	+ resistant	+ resistant	+ resistant	+ resistant
Potassium hydroxide · 10%	0 limited	– not resistant	+ resistant	+ resistant
Acetic acid · 75%	0 limited	– not resistant	+ resistant	+ resistant
Methyl ethyl ketone · 100%	– not resistant	– not resistant	– not resistant	– not resistant

+ resistant, 0 limited resistance (check with the supplier), – not resistant. Methyl ethyl ketone attacks both matrices: solvents are a separate screening question.

What a chemical specification states

Property	What to agree	Methods
Chemical compatibility	Provide chemical names or composition, concentration basis, normal / maximum temperature and impurities. Methods cover related subjects but are not automatically equivalent.	GB/T 3857; ASTM D543; ISO 175 as applicable
Immersion, splash & vapor exposure	Continuous immersion differs from occasional splash. Define dwell time, drying, cleaning, stress and sample edge sealing.	Agreed chemical-resistance test program
Mass, dimensions & appearance	Record swelling, cracking, blistering or exposed fibers together with the measurement and conditioning procedure.	ASTM D543; GB/T 3857
Retained mechanical properties	Compare matched exposed and control specimens. A short immersion test does not establish a service life in years.	Exposure protocol + relevant mechanical method
UV, moisture & outdoor aging	Specify coating / veil, exposure cycle and residual properties. Appearance retention and structural retention are separate criteria.	ISO 4892-3; ASTM G154; GB/T 2573, as applicable

Takeaway. A chemical name or pH alone is insufficient. Include mixtures, cleaning chemicals, temperature excursions and sustained stress, then agree the acceptable change in mass, appearance and mechanical properties. A 2,000 h third-party immersion program (sulfuric acid, sodium hydroxide, chlorine; ASTM D543 and ISO 175 methodology) on vinyl ester and isophthalic polyester profiles is being commissioned; ask whether its results bear on a current project.

Fire and smoke

Formulation	Fire behavior F1 states for it
E23-ISO	Standard grade — not fire-retardant (specify an FR grade for ASTM E84 Class 1)
UP-E17	Standard grade — not fire-retardant (specify an FR grade for ASTM E84 Class 1)
FR-E23	ASTM E84 Class 1 (flame spread ≤ 25), UL 94 V-O — FR resin; certified test report required per profile
VE-E23	ASTM E84 Class 1 (flame spread ≤ 25) + low smoke — FR vinyl ester; certified test report required per profile
EP-E23	Not inherently fire-retardant
PU-E23	Additive-dependent — specify an FR grade for ASTM E84 Class 1
PH-E23	ASTM E84 Class 1 (inherent, no additives), low smoke & low toxicity — phenolic; certified test report required per profile

Fire performance belongs to the resin formulation, its thickness, finish and installation, never to the E23 grade or to fiberglass in general. Standard isophthalic polyester is **not** fire-retardant. Fire-retardant polyester and vinyl ester carry halogen or alumina-trihydrate packages that reach ASTM E84 Class A (Class 1, flame-spread index 25 or less) in building applications; phenolic is inherently low

in flame spread, smoke and toxicity (reaction to fire, not fire resistance in minutes) and is the choice for rail interiors, tunnels and offshore. In every case the classification comes from the test report of the exact formulation quoted, per profile where the standard requires it.

Classifications are not interchangeable

Test or class	What it measures	What it does not establish
UL 94 (V-O, V-1, HB)	Small-flame burning of a plastic specimen at a stated thickness	Building-product fire performance; a result at 10 mm does not cover a 3 mm wall
ASTM E84 (Class A/B/C)	Flame-spread and smoke-developed indices in the 25 ft tunnel; Class A ≤ 25 / ≤ 450	Fire resistance; a flame-spread index without the smoke index and mounting details is incomplete
EN 13501-1 (A1 to F, s, d)	Reaction to fire of a construction product in its end-use condition, with smoke and droplet classes	A UL 94 or E84 result; each European class needs its own classification report
EN 45545-2 (HL1-HL3)	Rolling-stock requirement sets by hazard level and product listing	Building classifications; rail projects need the listed tests for the part
GB 8624	Chinese reaction-to-fire classes (2012 edition current; 2025 edition from 1 January 2027)	European or North American classes
EN 13501-2, ASTM E119	Load-bearing fire resistance (minutes of integrity, insulation and load) of an element	Nothing above; F1 makes no fire-resistance claim for catalog profiles

Evidence on file

SGS GZMR260702529004 (2026-07-30): Chongqing Xianju glass-fiber-reinforced composite profile E-TS-AB, tested as longitudinal A1 sheet specimens at 10.1 mm thickness. UL 94-2023 Rev.2-2024, Section 8: V-O, Pass. This result applies to the specified material and tested thickness. It does not establish V-O for thin-wall PV frames or replace the V-1 result in the separate Wuxi frame report (CPVT 2025DACS20319, on the website evidence page). SGS states that this report is for internal reference. [TEST REPORT](#)

Flame-spread reports for fire-retardant grades are issued per profile on request. A third-party program on

phenolic and fire-retardant polyester variants (EN 45545-2 hazard levels and ASTM E84 with smoke density and toxicity) is being commissioned; its reports will be added to the website evidence index.

Specifying fire

- Name the market classification and the end-use condition (wall thickness, finish, orientation, substrate), not just "fire retardant".
- Ask for the test report of the quoted formulation, with the laboratory, specimen and date, and check that it covers the supplied thickness.
- State smoke and toxicity requirements separately; optical smoke density does not quantify toxicity.
- Treat fire resistance (minutes) as a separate structural question with its own evidence.

Weathering, temperature, moisture and electrical insulation

UV and outdoor exposure

The resin at the surface, not the glass, degrades under UV: unprotected laminates chalk and expose fiber ("fiber bloom"), which is cosmetic first and structural only after years of neglect. Outdoor configurations use a UV-stabilized resin, a surface veil and, where the project needs color retention, a compatible coating. Appearance retention and structural retention are separate acceptance criteria: ask for exposure cycle, hours and retained flexural properties (ISO 4892-3, ASTM G154 or GB/T 2573) for the offered surface system. A 5,000 h ASTM G154 Cycle 1 program on polyester, vinyl ester and UV-stabilized systems is being commissioned to publish original data; until it is, no weathering rating is claimed for the catalog.

Temperature

Glass-transition temperature, heat-deflection temperature and continuous service temperature are different quantities. Stiffness falls as the matrix approaches its T_g ; the ASCE screening path limits service

temperature to $T_g - 22\text{ °C}$, and the environment factor for 32 to 60 °C service is 0.7 on strength. Typical heat-deflection and T_g ranges by resin are in the resin table of Section 2; they are supplier ranges, not F1 measurements. Specify the continuous and peak temperatures, their duration, moisture and sustained load together, and ask for the measured T_g (ISO 11357-2 or ASTM E1640) of the formulation. For service below -20 °C ask for low-temperature impact and flexural data of the formulation; none is published for the catalog laminate.

Moisture

Water absorption of the standard laminate is 0.6 percent at 24 h (EN ISO 62) **TYPICAL**. Wet or immersed service takes the 0.75 strength and 0.90 stiffness factors of Section 3 for a polyester matrix; vinyl ester resists hydrolysis better. Seal cut ends and drilled holes so that water does not wick along the rovings. A 28-day boiling-water program (ASTM D570, extended) is being commissioned for water-treatment and marina specifiers.

Electrical insulation

Glass-fiber profiles are selected for electrical insulation; carbon reinforcement or conductive additives change that. Dielectric strength is a laboratory result at a stated thickness and conditioning, not an operating-voltage rating: equipment design must account for creepage, clearance, moisture, contamination, joints and the applicable equipment standard. Request the volume and surface resistivity (IEC 62631-3-1/-3-2 or ASTM D257), dielectric strength (ASTM D149 or IEC 60243-1) and, for crossarms and switchgear, tracking (ASTM D2303, IEC 60112) for the exact laminate, with the test direction stated.

Service life and maintenance

Design life and maintenance depend on the material system, loads, exposure, connections and inspection plan. No universal service life or maintenance-free interval applies to the full catalog. FRP avoids steel-like rusting, but chemical resistance depends on resin, medium, concentration, temperature and exposure. Confirm compatibility, surface protection and maintenance for the proposed application. What FRP removes is the recoating cycle of steel and the galvanic couple of aluminum; what remains is periodic cleaning, an annual inspection of fixings, joints and cut edges (Section 8), and replacement of any damaged member. The website life-cycle cost calculator compares that against galvanized or painted steel as present values, and reports the cases where steel is cheaper.

08

Fabrication, installation and maintenance

Plan cutting, drilling and assembly from the approved finished-part drawing. Confirm tooling, support, datums, tolerances, edge treatment and inspection for the actual laminate and section before production. The illustrated machining guide at www.f1composite.com/technology/frp-profile-machining explains the RFQ and first-article requirements.

Cutting and drilling

Operation	Tool	Practice
Straight cuts	Carbide-tipped or diamond tooling selected for the laminate	Support stock and offcut. Select speed, feed and cooling for the tool and material; validate on trial pieces.
Curves and notches	Saw or router selected for the feature and access	Follow approved radii and remaining-section limits. Structural cutouts need an engineering check.
Holes	Sharp drill or hole cutter selected for the material and quantity	Back the exit face where accessible. Check finished diameter, position and both faces; countersinks require a drawing detail.
Finishing	Abrasive tool matched to the specified edge finish	Remove loose fibres within drawing limits. Chamfer only as specified; protect adjacent veil and reinforcement.
Dust	Tool extraction and task-appropriate eye, skin and respiratory protection	Follow the supplied safety data sheet, tool instructions and site risk assessment for FRP dust.

Exposed-edge treatment

Agree treatment of cut ends, holes and notches for the resin, service environment and mating surfaces. Where sealing is required, specify compatible material,

preparation, cure and inspection in the quotation.

Deburring and sealing are separate operations; sealing does not restore damaged reinforcement. Check critical fits in the agreed finished condition.

Fasteners

- Stainless-steel A2 (304) or A4 (316) bolts for most service; A4 in marine and chemical plants; FRP studs and nuts where a non-conductive or non-magnetic joint is required.
- Use specified washers, sleeves and backing plates; follow the approved tightening method. Avoid laminate crushing.
- Edge and end distances, hole clearance and slots follow the approved connection drawing (Section 3).
- Isolate carbon-steel hardware with sleeves and washers; never let a steel bolt bear directly on FRP in wet service.

Storage and handling

- Store on level supports spaced for the section, length and bundle weight; agree support points and packaging to control sag and surface damage.
- Use suitable slings and the agreed lifting points. Assess actual bundle mass, length and sharp edges before choosing manual or mechanical handling.
- Protect edges from impact. Quarantine chipped or delaminated parts for disposition; resin coating alone does not repair structural damage.
- Keep profiles dry before bonding; abrade and solvent-clean bonding surfaces.

Before work starts. Confirm that the design has been accepted by the engineer of record and the authority having jurisdiction, brace the structure before releasing the crane or props, follow the power-tool manuals, and use the gloves, eye protection and respirator the task needs.

Installation, safety data, cleaning and inspection

Bolt-up sequence for a platform or stair

- 01
- Set out and anchor the base plates; check level and the anchor edge distances in the concrete.
- 02
- Erect columns and primary beams loose-bolted; plumb and square, then brace before releasing the crane or props.
- 03
- Add secondary beams, stair stringers and landings; drill on site only through members that are drawn for it.
- 04
- Fit grating, treads and kick plates; grating clips at every bearing, not only at the corners.
- 05
- Install posts, rails and splices; check rail height and post spacing against the code case in Section 6.
- 06
- Apply the approved tightening and exposed-edge treatment, remove swarf and dust, and record the inspection.

Annual inspection

- Bolted connections: tightness, washer condition, corrosion of steel hardware, cracking around holes.

Safety data summary

General statements for a cured glass-fiber thermoset laminate; the safety data sheet of the supplied formulation governs and is sent with the order on request.

Item	Information
Product	Glass-fiber reinforced thermoset profile (isophthalic polyester standard; other matrices as ordered). Common names: GRP, FRP, fiberglass.
Normal handling	Not hazardous; the cured laminate is inert and does not release monomer.
Cutting and grinding	Dust may irritate eyes, skin and the respiratory tract. Use extraction and the PPE above; wash exposed skin with soap and water.
Fire	Combustible; burning resin releases dense smoke and irritant gases. Use water spray, foam or dry powder; firefighters wear breathing apparatus.
First aid	Eyes: rinse with clean water for at least 10 minutes, lids held open; seek attention if irritation persists. Skin: wash; moisturize. Inhalation of dust or fumes: fresh air; medical attention for decomposition fumes. Ingestion: rinse the mouth, do not induce vomiting.
Disposal	Inert, non-leaching solid; dispose of off-cuts and dust as construction waste under local rules.

Cleaning

Ordinary dirt leaves with a stiff brush and warm water with a mild alkaline detergent, followed by rinsing; use a water-based degreaser at the maker's dilution for traffic film or grease. A pressure washer may be used up to about 100 bar (1,500 psi) with the nozzle kept well clear of the surface and moving; closer or hotter jets erode the veil. Clean more often in high-traffic and food areas and on anti-slip surfaces, whose grit holds dirt.

Do	Do not
Clean before first use and remove spills of oil, grease, food and chemicals promptly	Exceed the cleaner's recommended concentration or mix cleaning chemicals
Use brushes rather than mops; rinse thoroughly	Use solvent or strong-acid cleaners: they attack the resin surface
Remove mold at first appearance with warm soapy water	Use abrasive pads or wire brushes on textured or coated surfaces
Clear snow and ice with a plastic shovel or broom	Use metal tools, which score the finish and expose fiber
Refer chemical spills to the resistance review in Section 7; dilute and rinse	Flood electrical interfaces or bolted joints with high-pressure water

- Adhesive joints: bond-line cracks, debonding at the edges, discoloration.
- Cut edges, holes and notches: specified treatment intact; check exposed fibres and moisture damage.
- Surfaces: chalking, fiber bloom, impact damage, wear-through of anti-slip grit on treads and grating.
- Members: deflection under the normal load compared with the first inspection; local crushing at bearings; cracks at re-entrant corners.
- Record findings with photographs. Follow the engineer's repair or replacement disposition and the approved fastener maintenance procedure.

Repairs

Surface damage that has not cut rovings is abraded, cleaned and recoated with a compatible resin or gel coat. Damage that cuts rovings in a load-bearing member is a structural repair: replace the member or splice it to an engineer's detail. Keep a record of repairs with the inspection file.

09

Ordering, documents and contact

What a quotation needs, what F1 confirms in it, the documents that exist today for the profile range and how to reach the engineering team. We will acknowledge your requirements within one business day and confirm the next step. A formal quotation follows specification and delivery review.

What to send with an inquiry

- Section designation or drawing, with the dimensional tolerance class or the agreed limits.
- Cut length and number of pieces, end cuts, holes and machining; whether F1 seals cut faces.
- Service environment: chemicals and concentrations, temperature range, UV, immersion or splash, fire requirement and market.
- Resin system, color and finish; or the exposure, and F1 proposes them.
- Load case and design code, or the span, loads and support conditions for a checked section.
- Required documents: mill certificate, inspection plan, test reports, STEP or DXF, submittal package.
- Delivery country and postcode, target date, sample requirement, Incoterm.

Dimensional acceptance fields on the drawing

Feature	Agree
Width, depth & outside diameter	Identify open or closed section, size band and measurement points. State whether an internal or external dimension controls the fit.
Wall thickness & corner geometry	Measure walls, webs and flanges separately. Specify radii and local transitions, especially near screw channels or mating features.
Cut length & end squareness	Separate as-pultruded supply from precision-cut parts. Define cut-face sealing and machining allowances.
Straightness, bow & camber	Record support condition, measurement plane and gauge length. A per-meter value does not automatically define the full-length limit.
Twist, angularity & flatness	Name the reference face and measurement span. Check engagement and assembly clearance on the mating parts.
Surface quality & fabricated holes	Define acceptable cracks, exposed fibers, chips and surface defects. Hole position and diameter need separate fabrication tolerances.

Comparing quotations

Topic	Compare on the same basis
Section and material	Compare the same geometry, tolerances, resin, reinforcement and finish.
Quantity and tooling	Separate production quantity, minimum run, die cost, sampling and tooling ownership.
Evidence	Match report holders, tested specimens, grades and acceptance criteria to the offered product.
Delivered cost	Use the same quotation date, currency, Incoterm, destination, packing and tax assumptions.
Schedule and support	Confirm drawing release, sample approval, production, inspection, shipping and after-sales scope.

Takeaway. There is no single $\pm$ tolerance for every pultruded shape. Confirm the standard, edition, size band, datum and measurement length before approving the drawing. ASTM D3917 uses inch-pound values as the normative units.

Documents for the profile range

Published on the website evidence page

Document	Issuer and reference	Tested or described	Result or scope	Date
E40 evidence — SGS full-section test, 40.8 GPa	SHIN2608002943CM01_EN	Square tube sample; the report lists specification 60605 and specimen 2160 × 90 × 90 mm	Full-section modulus 40.8 GPa, mean of three specimens (41.2, 41.1, 40.1)	Issued 2026-09-07
E40 evidence — SGS full-section test, 41.5 GPa	SHIN2608002943CM02_EN	Square tube sample; the report lists specification 90905 and specimen 1440 × 60 × 60 mm	Full-section modulus 41.5 GPa, mean of three specimens (41.1, 42.1, 41.3)	Issued 2026-09-07
PU-GF pultruded profile mechanical data	PU-GF data sheet	Custom pultrusions	The material system and methods identified in the sheet. Confirm whether each value is typical, measured or a design value before applying it to another laminate or section.	—
Composite profile material flammability test report	SGS GZMR260702529004	Composite profile material E-TS-AB, 10.1 mm longitudinal specimens	V-0 at 10.1 mm. Report marked for internal reference.	Issued 2026-07-30
EPD & Carbon Footprint — Pultruded GFRP Composite Profiles	CABR Certification Center	Pultruded GFRP composite profile products, 1 m ² functional unit	Cradle-to-gate 33,934 g CO ₂ e/m ² ; cradle-to-grave 36,099 g CO ₂ e/m ² (GB/T 24025, ISO 14067, PAS 2050)	Issued 2025-04-30

On request, with holder, number and scope

- ISO 9001 quality-management certificate of the manufacturing entity.
- CE declaration of performance where the product and intended use have an assessment route.
- Fire test reports for fire-retardant and phenolic formulations, per profile.
- Chemical-resistance data of the resin supplier for the quoted system.
- Batch mill certificates and inspection records as agreed before production.
- STEP models, project submittal packages and third-country compliance dossiers.

Engineering tools on the website

Tool	Address
Profile finder (filter the catalog, compare four sizes)	www.f1composite.com/tools/profile-finder
Profile calculator (bending, shear, deflection; any code)	www.f1composite.com/frp-profile-calculator
Span tables (this manual's Section 5, live)	www.f1composite.com/frp-span-tables
Column buckling	www.f1composite.com/tools/frp-column-calculator
Handrail load check	www.f1composite.com/tools/handrail-load-calculator
Access geometry checker (ladders, stairs, walkways)	www.f1composite.com/tools/access-geometry-checker
Thermal expansion, unit converter, cut-list optimizer, life-cycle cost	www.f1composite.com/tools
Datasheet and DXF of every size	www.f1composite.com/datasheets
Evidence index (all reports and certificates)	www.f1composite.com/resources/evidence

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Specifications may change without notice as the catalog and its evidence are revised; the website carries the current data and the revision of this document. The tables are preliminary-sizing aids, not a project approval or a batch certificate. The "F1" in F1 Composite stands for "Fiber One" (fiberglass). F1 Composite is an industrial FRP company and is not affiliated with Formula 1, Formula One motorsport or the FIA.