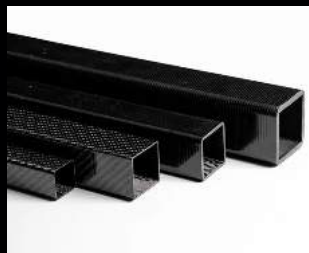




Buyers Guide

Carbon Fibre Tube

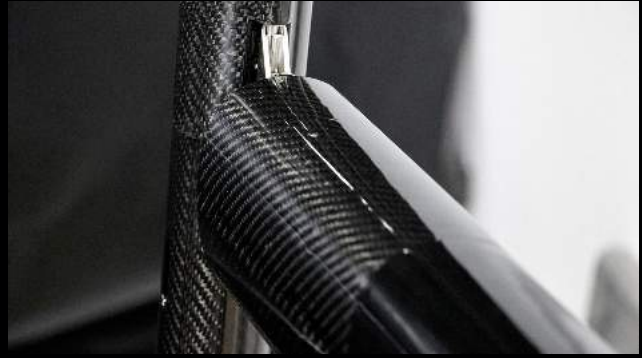


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Our sales process:



Our Sales Interaction

At C-Tech, we understand that selecting the right carbon fibre tube can be a complex process. **Our sales team plays a crucial role in guiding you through this journey.** From your initial enquiry, we work closely to specify the right tube specification based on your custom requirements.

Understanding Customer Needs

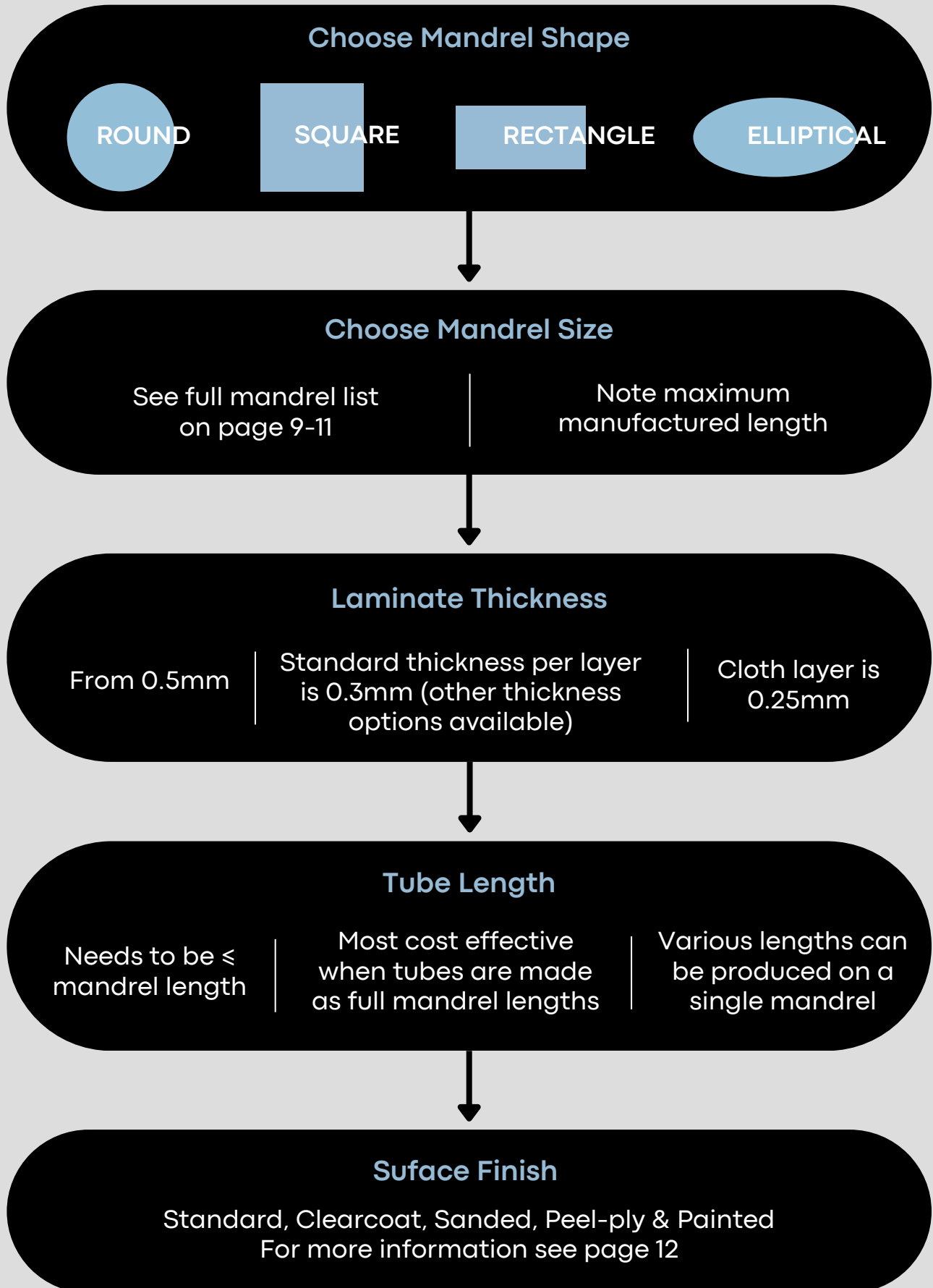
We emphasise the importance of **understanding your specific needs to determine the correct mandrel, laminate, cure process and finishing to provide the optimal strength, stiffness, weight & appearance.** Our team is dedicated to providing custom solutions tailored to your unique applications, ensuring optimal performance. This is why we do not carry stock of finished tubes, as every project is different.

Our Mandrels

Our manufacturing process uses mandrels for roll wrapping carbon fibre tubes. **This technique guarantees high-quality, consistent tubes across all shapes.** Using mandrels means we have a select range of over 200 mandrel options to choose from to start your tube order. See full mandrel list on pages 7-9. Additionally, where the outside surface is the most important requirement, **we can commission moulds and laminate female moulded parts for the ultimate out of mould outside surface.**

Selection Process

Here's a few easy steps.



Laminate Specification:

In most cases, the tube wall thickness is specified by the customer in the initial enquiry, or our sales team after understanding the requirement.

The below information is to give customers a greater understanding of our processes. All our tubes are made using prepreg carbon fibre. This consists of fibre that is pre-impregnated with specialised resins and frozen in a pre-cured state. Prepreg enables optimised ratios of fibre to resin, resulting in the highest material properties and lowest weight, compared with laminating techniques such as wet layup or infusion. Our production staff remove the fibre from the freezer, cut it to the desired shape using our CNC plotter, laminate the layers onto the mandrel, consolidate the laminate using various techniques to reduce voids and cure the part in a heated oven.



Our tubes are made up of a mixture of carbon fibres oriented:

0° direction

These are specified to give stiffness to the tube. (Along the length of the tube).

Off-axis (0 to 90°)

Various angles, predominantly $\pm 60^\circ$ for standard laminates, but can be any angle from 0 to 90°.

These are specified for various reasons, including:

- Transferring the applied loads in shear around the cross section of the tube to engage all the 0° fibre. A tube without off-axis fibre would rely entirely on the resin to transfer the loads in shear, resulting in a much weaker structure overall.
- To resist torsion/twisting (imagine twisting a tube, fibres spiralling in opposing directions around the tube resisting this twist).
- Offer radial (around the tube) strength for applied internal or external pressure
- Offer a better surface for machining or drilling holes to resist splitting.

The individual layers are made up of three types of fibre:



Unidirectional

All fibres are aligned in one direction.



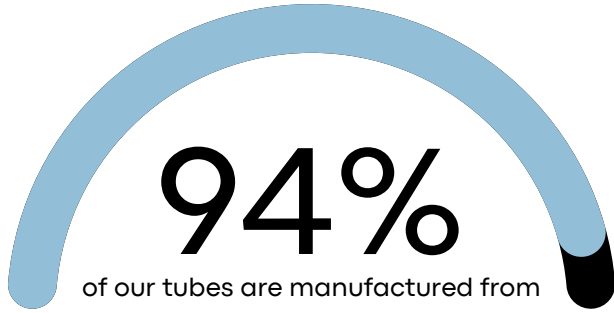
Biaxial

Layers are made up of fibres in two directions, generally 0/90° or ±45°.



Cloth

Fibres are woven together in two directions, generally 0/90°.



of our tubes are manufactured from unidirectional fibre only, or unidirectional and cloth fibre, using our standard laminate specifications and stocked carbon fibre prepreg.

C-Tech holds stock of over **40 different types** of carbon fibre prepreg, with the most frequently used being:

- **PCU300** – Prepreg Carbon Unidirectional, with areal weight of **300** grams per square metre, with a cured thickness of 0.3mm.
- **PCC200T** – Prepreg Carbon Cloth Twill Weave, oriented in 0/90° with areal weight of **200** grams per square metre, with a cured thickness of 0.25mm.

An example standard laminate is shown below, giving a 1.5mm wall thickness and a unidirectional outside layer:

Layer No.	Fibre Orientation	Fibre (gm)	Thickness (mm)
1	+60°	PCU300	0.30
2	0°	PCU300	0.30
3	0°	PCU300	0.30
4	-60°	PCU300	0.30
5	0°	PCU300	0.30
Total:			1.5

For tubes specified with a twill weave finish, the outside layer is replaced with a cloth, resulting in a slightly thinner laminate (1.45mm):

Layer No.	Fibre Orientation	Fibre (gm)	Thickness (mm)
1	+60°	PCU300	0.30
2	0°	PCU300	0.30
3	0°	PCU300	0.30
4	-60°	PCU300	0.30
5	0/90°	PCC200T	0.25
Total:			1.45

Our standard laminates have been developed over the history of the company, and result in the optimised ratio of unidirectional to off-axis fibre. Our innovative manufacturing processes allow the off-axis fibre to be applied to the mandrel with no laps or joins, resulting in a lack of visible joins on the outside surface due to these layers while retaining structural continuity.

Fibre Modulus

Carbon fibre is available with different material properties, referred to as the modulus. This relates to the stiffness of the fibre. The higher the modulus, the stiffer the tube.



90%

of customer orders are manufactured using standard modulus fibre. C-Tech only recommends the use of higher modulus fibre in special cases, e.g. where a greater stiffness is required for a given cross section. The metal equivalent would be changing from Aluminium to Titanium, with a similar increase in material cost.



MATERIAL PROPERTIES (E=YOUNGS MODULUS)

Standard Modulus (SM)

- E=250 GPa
- Failure strength = 5.6 GPa

Intermediate Modulus (IM)

- E=279GPa
- Failure strength = 5.6 GPa

High Modulus (HM)

- E=369 GPa
- Failure strength = 4.8 GPa

Ultra-High Modulus (UHM)

- E=426GPa
- Failure strength = 5.1 GPa

This is our stocked unidirectional fibre and the material properties are averages. While higher modulus = higher stiffness, it does result in a lower ultimate strength, which makes for a more brittle part overall. Tube designs will have lower average material properties than shown above as not all fibre is laid in the longitudinal (along the length) direction.

PLEASE NOTE: the material price approximately doubles at each step up in modulus.

ROUND TUBE MANDRELS

Diameter (mm)	Max Tube Length (mm)
12.70	3350
14.00	2670
16.00	3350
17.50	1650
19.00	3700
20.00	4790
21.00	4750
22.00	3810
25.00	6330
25.20	4810
25.40	4720
27.00	2520
28.00	1780
28.58	4810
29.00	4770
31.00	4810
31.50	250
31.80	4720
32.00	4850
32.20	4800
34.70	2850
34.75	4770
37.00	4800
38.00	4780
38.50	910
40.00	4780
41.00	780
41.20	4780
41.25	4610
41.28	4180
41.40	4100
42.00	820
44.20	6290

Diameter (mm)	Max Tube Length (mm)
44.50	4800
44.80	4280
45.00	3070
46.00	740
47.00	5730
47.60	4760
48.00	2700
48.40	5790
50.00	6230
50.40	4800
50.80	4800
52.00	1010
53.20	1050
54.00	5820
54.80	4500
55.00	4650
57.00	4800
58.00	4550
60.00	5800
61.50	5830
61.70	5790
63.50	5710
64.00	1050
65.00	4800
67.60	570
70.00	6250
72.00	4790
74.00	550
74.60	4600
76.00	4180
79.60	7800
80.00	4790
86.00	4790

Diameter (mm)	Max Tube Length (mm)
89.00	4750
90.00	4750
94.60	640
96.50	380
100.00	8750
101.40	1450
102.00	1770
105.00	2300
108.00	9400
110.00	2280
114.30	2480
120.50	2050
125.00	4760
128.00	2300
130.00	2000
140.00	5700
141.70	2000
150.00	6750
166.00	4730
171.00	4050
180.00	5700
190.00	5730
190.20	2420
200.00	5850
203.00	3010
212.00	5750
219.00	5750
230.00	5700
250.00	5730
273.00	5850
300.00	5700
323.00	5700
355.00	5750

SQUARE TUBE MANDRELS

Dim (mm)	Corner radius	Max Tube Length (mm)
10x10	R3	4790
19x19	Square	2800
19x19	Square	4730
19x19	R3	2250
20x20	R3	2800
20x20	Rounded	4820
25x25	Square	4710
25x25	Square	4800
25x25	Square	4800
28x28	R6	520
29x29	Rounded	480
30x30	Square	950
30x30	Square	3450
30x30	Square	2300
30x30	Square	2030
30x30	Square	4750
32x32	Square	4200
35x35	Square	4780
35x35	Square	4790
40x40	Square	4790
40x40	Square	4790
45x45	Square	4790
50x50	R6	5790
65x65	R6	4780
75x75	Square	4780
100x100	R6	5770

RECTANGLE TUBE MANDRELS

Dim (mm)	Corner radius	Max Tube Length (mm)
15x6	Rounded	1110
15.5x5	Square	1950
16x4	Square	2800
16x5	Square	3350
16x5.5	Square	1290
18x8	Square	1650
19x10	Square	1330
20x4.5	Square	1120
20x6	Square	1700
20x8	Square	1850
20x10	Rounded	1350
20x12	Square	2020
20x15	Square	2280
25x5	Square	2220
25x10	Square	900
25x12	Square	2300
25x15	Square	1110
25x20	Square	4800
25.5x6	Square	1150
26x8	Square	890
30x12	Square	2300
30.5x6	Rounded	1900
32.5x16	Square	2750
32.6x21	Square	2750
35x25	Square	4800
35.5x12	Square	1100
40x12	Square	4810
40x14	Rounded	2180
40x15	Rounded	2190
40x16	R6	4800
40x20	Rounded	2400
40x20	Square	4750
40x24.5	Rounded	305

Dim (mm)	Corner radius	Max Tube Length (mm)
40x25	Square	4810
40x25	Rounded	4790
46x20	Square	4630
46x36	Square	4750
46.5x30.5	Square	4750
50x10	Square	1050
50x23	Square	1600
50x25	Rounded	3810
50x25.5	Rounded	4820
50x30	Rounded	4810
50x38	Square	1520
50x40	Rounded	7850
55x28	Rounded	700
59x45	Square	1850
60x35	Rounded	5790
61x12	Square	2920
64x19	Square	1750
68x38	Square	1460
75x10	Square	1080
75x12	Rounded	4750
75x40	Square	3600
75x45	Square	4450
75x50	Rounded	5650
78.5x46	Rounded	1890
79x13.5	R6	750
80x25	Square	1900
100x50	Rounded	4780
125x12	Square	2270
126x89	Square	800
135x50	Square	4780
150x75	Rounded	4780
151x40	Rounded	4720
200x100	R8	4000

AEROFOIL TUBE MANDRELS

Dim (mm)	Max Tube Length (mm)
47x19	3710
73x30	390
90x30	5800
100x26	5800
123x58	5780
145x47	2550
150x38	2250

OVAL TUBE MANDRELS

Dim (mm)	Max Tube Length (mm)
32x18	3310
34x30	630
40x20	3690
55x31	2800
76x25	5800
100x52	5810
121x87	6200
138x94	7150
139x93	900

D-SHAPE TUBE MANDRELS

Dim (mm)	Max Tube Length (mm)
50x25	2100
40x20	5800
50x25	3250
118x81	3950
161x97	4770

FLAT OVAL TUBE MANDRELS

Dim (mm)	Max Tube Length (mm)
84x61	2880
30x15	5800
50x25	5800
60x30	5550
90x30	4450

OTHER CUSTOM MANDRELS ARE AVAILABLE, INCLUDING TAPERED SECTIONS.

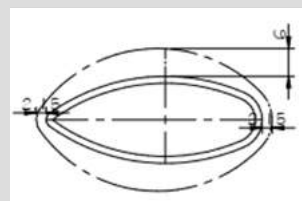
Square/rectangle tube laminate maximum thickness must be **≤10%** of shortest side e.g.

- 25x25 square: **wall thickness 2.5mm or less**
- 150x75 rectangle: **wall thickness 7.5mm or less**

Wall thickness will vary around cross section due to fibre migration away from corners due to pressure applied to laminate during cure.

Elliptical tube wall thicknesses will vary around cross section due to fibre migration away from corners due to pressure applied to laminate during cure.

Please indicate if parts are to be mated to outer geometry so as-built measurements can be supplied before dispatch for all tubes. Examples below.



Surface Finishes

Designed to make your composites corrosion resistant, UV stabilised and aesthetically pleasing. C-Tech provides finishes sustaining the long-term appearance of composite products.



Standard

Unidirectional or Cloth Finish

Glossy, unidirectional (spiral wound), cloth (woven or twill weave) effect.



Clearcoat

Unidirectional or Cloth Finish

Smooth, clear and glossy cloth or uni finish.

Please note that clearcoat is a painted finish that can significantly increase the tube price. In most cases standard finish is sufficient.



Sanded

Unidirectional or Cloth Finish

Sanded finish ready for painting or gluing, cloth or uni option.



Peel-ply

Unidirectional or Cloth Finish

Textured finish designed as a gluing surface. It can be used inside tubes to create a gluing surface in areas that are hard to sand. This finish also provides a good grip on tubes either cloth or uni.



Painted

Unidirectional or Cloth Finish

Sanded and painted, giving a high gloss and the best UV protective coating and a high quality finish. We can offer any colour that is commercially available for spray painting.

Or custom to suit your requirements...



Our Capabilities

Both our factories in Spain & NZ are over 2000sqm and offer the following:



OUR SERVICES

- Composite Part Manufacture
- Production
- Product Development & Prototyping
- CNC Machining & Tooling Manufacture
- Design & Engineering



OUR INFRASTRUCTURE

- **Clean Room:** Humidity & temperature controlled
- **Autoclave:** Temperature & pressure controlled (Max Internal Length: 15.3m Max Internal Diameter: 1.44m)
- **Plotter:** (Eastman S125)
- **5 Axis CNC Router:** Subtractive Manufacturing
- **Roll Wrapping Machines:** Custom Built



Quality Assurance

As part of C-Tech production processes, tubes are checked once cured to ensure:

- Outer dimensions are within standard tolerance
- Surface finish is acceptable



Additional chargeable services available (please advise during order process if any of these are required)

- Material certificates and/or cure logs supplied with order
- Mandrel survey before lamination, measuring in two directions at regular intervals
- Verification of tolerances in Customer Drawing
- QC Report can be supplied
- C-Tech Certificate of Conformity
- Bend testing to verify material properties (certain tube sizes only)
- Offsite mechanical testing available

Contact Us!



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