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Composite Tubes and Hollow Profiles

A Wide Range of
Tubular Composite Solutions

exel COMPOSITES

COMPOSITE TUBES AND HOLLOW PROFILES

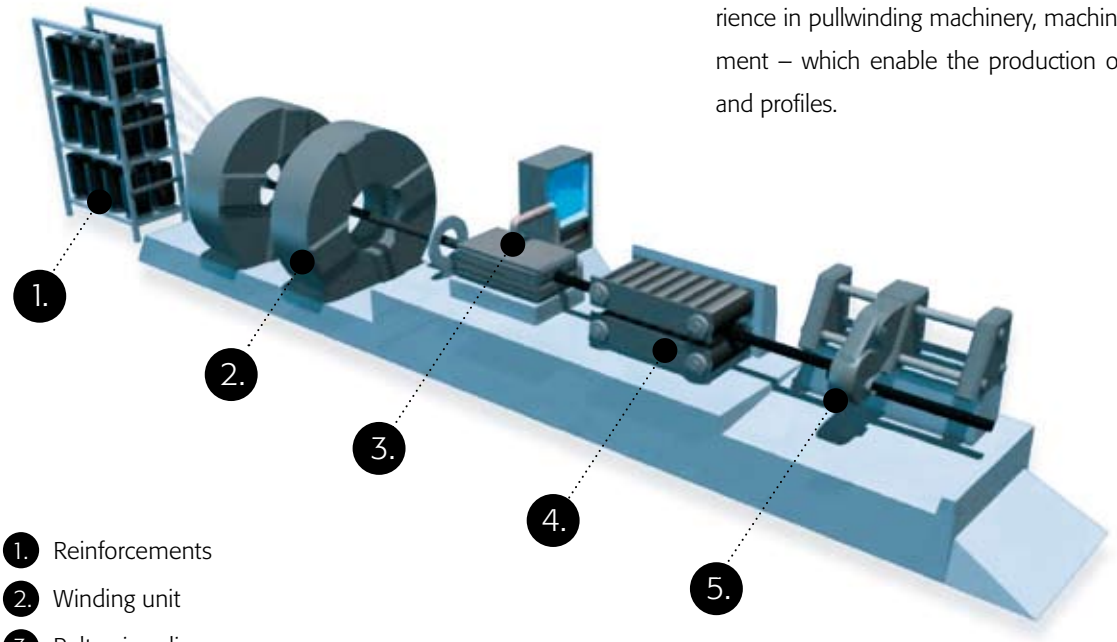
Exel Composites know-how in materials, design and technical properties enables the manufacture of high-performance composite tubes and hollow profiles.

What are composites?

Composites are a mixture of fibres and resin systems, which in combination result in a very strong and rigid material. The properties of the fibres are used to resist tensile and compressive loads, while the resin systems transfer shear. Because it is a combination of materials, a composite product can be combined and designed with a view to specific load-bearing capacities. Composites provide a number of advantages in relation to traditional materials, such as resistance to chemicals, as well as electrical and thermal insulating properties.

What is pullwinding?

Exel tubes and hollow profiles are produced with our own, internally developed continuous manufacturing technologies: pultrusion, pullwinding and co-winding. In these techniques reinforcement fibres impregnated with resin are drawn through a heated tool to form a product. The composite cures into its final shape as the thermoset resin hardens inside the die. The product is pulled out from the die by the pulling unit and is cut in desired length. Being a continuous process the product can be cut to any length. Pullwinding and co-winding technology gives the possibility to have accurate control of the crosswise and longitudial properties of the final product by adjusting the amount of fibres lengthwise and crosswise. Exel has long experience in pullwinding machinery, machine design and development – which enable the production of high precision tubes and profiles.



1. Reinforcements
2. Winding unit
3. Pultrusion die
4. Pulling unit
5. Sawing unit

Principle drawing of pullwinding process

EXELENS™

GLASSFIBRE TUBES AND HOLLOW PROFILES

- high quality tubes and profiles with very good surface finish
- nonwoven surface provides excellent finish and deep colours

STIFFNESS:	35–42 GPa
DENSITY:	p=1,90 g/cm³
	e.g. tube Ø30/27mm 255 g/m
COLOURS:	several colours available

EXELITE™

CARBON FIBRE TUBES AND HOLLOW PROFILES

- made from High Strength (HS) or High Modulus (HM) carbon fibres
- stronger, lighter and stiffer than Exelens

	HIGH STRENGTH (HS)	HIGH MODULUS (HM)
STIFFNESS:	90–100 GPa	160–200 GPa
DENSITY:	p=1,65 g/cm³	p=1,65 g/cm³
	e.g. tube Ø30/27mm 220 g/m	
COLOURS:	Black	Black

ULTRALITE™

THIN WALL CARBON FIBRE FABRIC TUBES

- reduced wall thickness compared to Exelite
- very good hoop strength and high stiffness, despite the thin 1mm wall
- attractive technical look

STIFFNESS:	80–85 GPa
DENSITY:	p=1,50 g/cm³
	e.g. tube Ø30/28mm 135 g/m
COLOURS:	Black, fabric surface

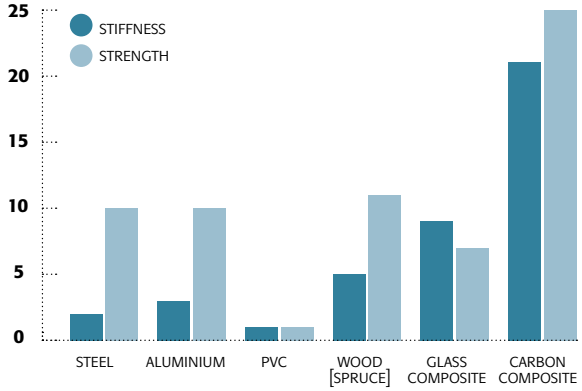
TAPERLITE™

CONICAL GLASS OR CARBON TUBES

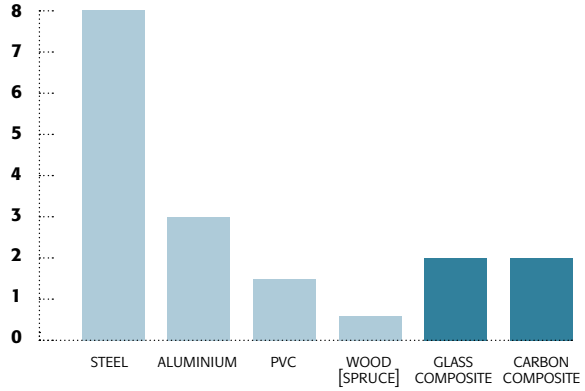
- co-winding manufacture technology
- wide variety of diameters, flexibility in dimensions
- tapered surface

STIFFNESS:	30–200 GPa, Glass 30–45 GPa
	HS carbon 90–140 GPa, HM carbon 200 GPa
DENSITY:	HS/HM carbon p=1,50–1,60 g/cm³, Glass 1,90 g/cm³
COLOURS:	Several colours available (GF), black (CF), fabric surface

Specific strength and stiffness normalized [compared to PVC = 1]



Density [kg/dm³]



Comparison of properties

	GF/PE	GF/VE	GF/EP	CF/VE	CF/EP
Stiffness*	G	G	G	VG	VG
Strength*	G	VG	E	VG	VG
Weight	G	G	G	VG	VG
Fatigue life	G	VG	E	VG	E
Impact resistance	G	VG	E	G	VG
Thermal expansion	G	G	G	E	E
Electrical insulation	G	G	VG	NR	NR
Thermal insulation	E	E	E	NR	NR
Weathering resistance	G	VG	G	VG	G
Corrosion resistance	G	VG	VG	VG	VG

GF/PE	glass fibre polyester
GF/VE	glass fibre vinylester
GF/EP	glass fibre epoxy
CF/VE	carbon fibre vinylester
CF/EP	carbon fibre epoxy

NR	not recommended
G	good
VG	very good
E	excellent

** Carbon fibre composite show significantly better overall performance compared to glass fibre in most mechanical applications.*

Crosswise fibres increase the maximum bending strength and deflection to failure of the tube.

A Lenghtwise fibres

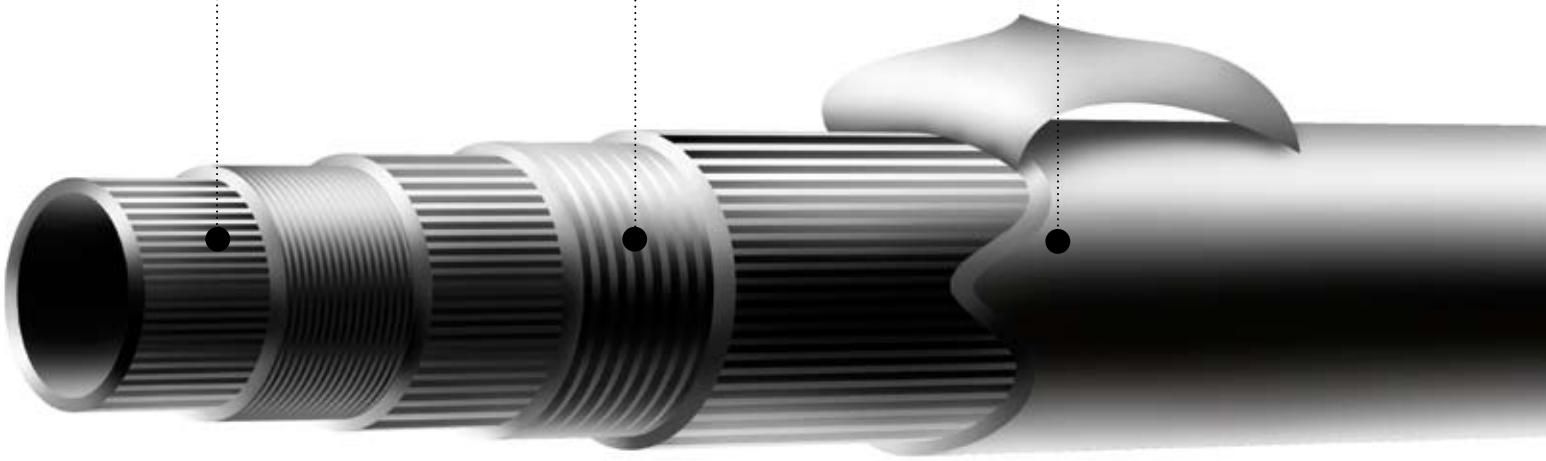
The lengthwise fibres bring the composite structure the strength and stiffness needed in the lengthwise direction. Alone they yield the highest stiffness possible, as the lengthwise fibres control the lengthwise properties. For maximum tensile strength lengthwise fibres are optimal.

B Crosswise fibres

Crosswise fibres tie together the tube structure to avoid the lengthwise layers from splitting. They keep the shape of the tube more stable. By adding crosswise strength to the composite structure they actually increase the maximum bending strength and deflection to failure of the tube.

C Surface

The tubes surfaces usually have a nonwoven or fabric surface. The nonwoven is a smooth pleasant single colour surface, while woven appearance is the popular "woven carbon fibre look". The surface can be coloured using a pigmented resin to any colour specification.



Optimized structure with minimized use of raw material

Our objective at Exel is to design and manufacture products that give our customers a leading position in their businesses.

Minimum wall thickness, high stiffness and strength

Pullwinding process enables the reduction of wall thickness and weight while retaining and improving stiffness and strength compared to conventional pultrusion. Each product is carefully optimized according to application and requirements by combining suitable fibres and resin systems and utilizing certain amount of lengthwise and crosswise layers. The range of standard diameters vary from 3 mm to 300 mm. See the tube lists at our website: www.exelcomposites.com or ask for more details.

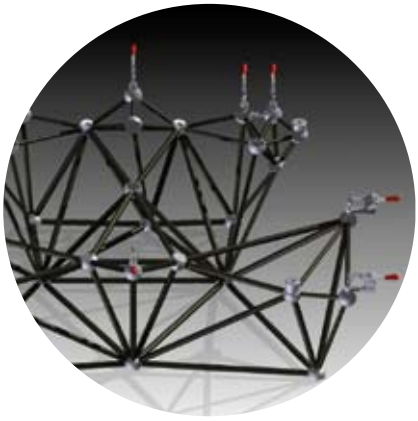
Your benefits

• lightweight • strong • stiff • electrically insulating • chemical resistant • weather proof • thermally insulating • good surface quality • versatile structures • dimensionally stable

Typical application areas for conical co-wound tubes are antennas, masts, furniture applications, tool handles, paddle shafts, sport shafts and windsurfing masts.

Examples of applications

• tool handles • telescopic structures • profiles for the furniture industry • sprayer lances • various lightweight structures, e.g. lightweight shelters • fence structures • sports equipment • kite tubes • tubes for skiing poles • profiles for machine engineering, e.g. manufacture of weaving looms • electrical insulation tubes for the process industry • tubes for measuring devises and alignment • robot arms • equipment for the defence industry • caravan awnings • tent structures • lighting poles • antenna tubes • camera tripods • System 30 structures • ladders • handrails



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Exel is a leading manufacturer of advanced composite products and solutions, meeting the requirements of environmental legislation, rules and regulations. We use only tested materials that are safe for the environment. Due to their long life and durability, composites always offer ecologically safe solutions. Exel is committed to develop the products and processes to reduce the environmental impact. The Exel quality and environmental policy complies with the requirements of the standards ISO 9001:2000 and ISO 14001.

ISO 9001
BUREAU VERITAS
Certification
N° 204747A

2009