

Torayca™ M46J carbon fiber is a high modulus fiber with enhanced tensile and compressive strength. Its high tensile strength and modulus makes Torayca™ M46J the fiber of choice for space applications such as satellites, motorsports and marine applications. Manufactured in France and Japan.

PRODUCT DESIGNATION

M46J	B	6 000	5	0	A
Fiber Type	Twist*	Filament Count	Sizing Type	Surface Treatment	Sizing Amount

*Blank: Twisted
B: Untwisted

RESIN SYSTEM COMPATIBILITY

SIZING TYPE & AMOUNT	RESIN SYSTEM COMPATIBILITY	METHOD
50A / 50B (1%)	Epoxy, phenolic, polyester, vinyl ester	TY-QA-005

FIBER PROPERTIES

PROPERTY	UNIT	FILAMENT COUNT	NOMINAL VALUE*	METHOD
Tensile Strength	MPa (kgf/mm ²)		4200 (430)	TY-QA-002
Tensile Modulus	GPa (10 ³ kgf/mm ²)		436 (44.5)	TY-QA-002
Elongation	%		1.0	TY-QA-002
Density	g/cm ³		1.84	TY-QA-003
Yield	g/1000m	6 000	223	TY-QA-004
		12 000	445	

* Lot properties are reported as average values of a test set per bobbin sampled. The stated values are typical values. For design purposes, please contact us.

FUNCTIONAL PROPERTIES

PROPERTY	UNIT	FILAMENT COUNT	NOMINAL VALUE
Specific Heat	Cal/g.°C		0.17
Electric Resistivity	x 10 ⁻³ Ω.cm		0.9
CTE	α10 ⁻⁶ /°C		-0.9
Thermal Conductivity	Cal/cm.S.°C		0.202
Filament Diameter	μm		5
Cross Sectional Area	mm ²	6 000	0.12
		12 000	0.24

COMPOSITE PROPERTIES*

PROPERTY	UNIT	NOMINAL VALUE
Tensile Strength	MPa (kgf/mm ²)	2210 (225)
Tensile Modulus	GPa (10 ³ kgf/mm ²)	265 (27.0)
Tensile Strain	%	0.8
Compressive Strength	MPa (kgf/mm ²)	1080 (110)
Flexural Modulus	GPa (10 ³ kgf/mm ²)	220 (22.5)
ILSS	MPa (kgf/mm ²)	80 (8)

* Toray 2500 – 120°C resin system. Measured temperature: RT. Normalized to 60% fiber volume.

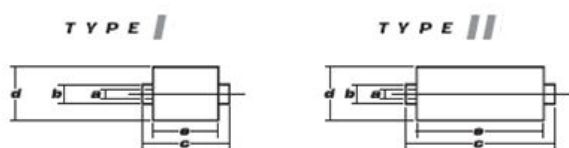
PACKAGING

Each bobbin of TORAYCA carbon fibre is protected against dust and packed in container to prevent damage during transportation

The table below summarizes the tow sizes and packaging available for standard material. Other bobbin sizes may be available on a limited basis.

TOW SIZES	BOBBIN NET WEIGHT (kg)	BOBBIN TYPE	BOBBIN SIZE (mm)					SPOOL PER CASE	CASE NET WEIGHT (kg)
			a	b	c	d	e		
6K	1.0	I	76	82	192	126	156	16	16
12K	2.0	I	76	82	192	157	156	12	24

BOBBIN TYPE:



Please refer to SDS for handling and disposal.

REQUIREMENTS

Shelf Life: 24 months from month of manufacture, if stored under ambient condition

TORAY CARBON FIBERS EUROPE S.A.

SALES AND MARKETING DIVISION
18 – 20 Avenue de la Porte d'Italie
75013 PARIS, FRANCE

HEAD OFFICE
Route Départementale 817
64170 LACQ, FRANCE

PLANT
Route de Lagor
64150 ABIDOS, FRANCE

Torayca™ M50J carbon fiber is a high modulus fiber with enhanced tensile and compressive strength. Its high tensile strength and modulus makes Torayca™ M50J the fiber of choice for high-performance sport applications. Manufactured in Japan.

PRODUCT DESIGNATION

M50J	B	6 000	5	0	B
Fiber Type	Twist*	Filament Count	Sizing Type	Surface Treatment	Sizing Amount

B: Untwisted

RESIN SYSTEM COMPATIBILITY

SIZING TYPE & AMOUNT	RESIN SYSTEM COMPATIBILITY	METHOD
50B (1%)	Epoxy, phenolic, polyester, vinyl ester	TY-QA-005

FIBER PROPERTIES

PROPERTY	UNIT	FILAMENT COUNT	NOMINAL VALUE*	METHOD
Tensile Strength	MPa (kgf/mm ²)		4120 (420)	TY-QA-002
Tensile Modulus	GPa (10 ³ kgf/mm ²)		475 (48.5)	TY-QA-002
Elongation	%		0.9	TY-QA-002
Density	g/cm ³		1.88	TY-QA-003
Yield	g/1000m	6 000	216	TY-QA-004

* Lot properties are reported as average values of a test set per bobbin sampled. The stated values are typical values. For design purposes, please contact us.

FUNCTIONAL PROPERTIES

PROPERTY	UNIT	FILAMENT COUNT	NOMINAL VALUE
Specific Heat	Cal/g.°C		0.17
Electric Resistivity	x 10 ⁻³ Ω.cm		0.9
CTE	α10 ⁻⁶ /°C		-1.0
Thermal Conductivity	Cal/cm.S.°C		0.234
Filament Diameter	μm		5
Cross Sectional Area	mm ²	6 000	0.11

COMPOSITE PROPERTIES*

PROPERTY	UNIT	NOMINAL VALUE
Tensile Strength	MPa (kgf/mm ²)	2010 (205)
Tensile Modulus	GPa (10 ³ kgf/mm ²)	295 (30.0)
Tensile Strain	%	0.7
Compressive Strength	MPa (kgf/mm ²)	980 (100)
Flexural Modulus	GPa (10 ³ kgf/mm ²)	240 (24.5)
ILSS	MPa (kgf/mm ²)	80 (8)

* Toray 2500 – 120°C resin system. Measured temperature: RT. Normalized to 60% fiber volume.

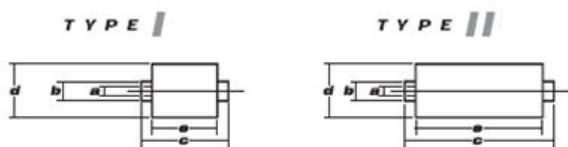
PACKAGING

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			a	b	c	d	e		
6K	1.0	I	76	82	192	126	156	16	16

BOBBIN TYPE:



Please refer to SDS for handling and disposal.

REQUIREMENTS

Shelf Life: 24 months from month of manufacture, if stored under ambient condition

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PLANT
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64150 ABIDOS, FRANCE

Torayca™ M55J carbon fiber is a high modulus fiber with enhanced tensile and compressive strength. A class-leading carbon fiber in terms of mechanical properties Torayca™ M55J is able to meet mechanical performance and dimensional stability requirements of demanding aerospace applications. Manufactured in France and Japan.

PRODUCT DESIGNATION

M55J	B	6 000	5	0	B
Fiber Type	Twist*	Filament Count	Sizing Type	Surface Treatment	Sizing Amount

B: Untwisted

RESIN SYSTEM COMPATIBILITY

SIZING TYPE & AMOUNT	RESIN SYSTEM COMPATIBILITY	METHOD
50B (1%)	Epoxy, phenolic, polyester, vinyl ester	TY-QA-005

FIBER PROPERTIES

PROPERTY	UNIT	FILAMENT COUNT	NOMINAL VALUE*	METHOD
Tensile Strength	MPa (kgf/mm ²)		4020 (410)	TY-QA-002
Tensile Modulus	GPa (10 ³ kgf/mm ²)		540 (55.0)	TY-QA-002
Elongation	%		0.8	TY-QA-002
Density	g/cm ³		1.91	TY-QA-003
Yield	g/1000m	6 000	218	TY-QA-004

* Lot properties are reported as average values of a test set per bobbin sampled. The stated values are typical values. For design purposes, please contact us.

FUNCTIONAL PROPERTIES

PROPERTY	UNIT	FILAMENT COUNT	NOMINAL VALUE
Specific Heat	Cal/g.°C		0.17
Electric Resistivity	x 10 ⁻³ Ω.cm		0.8
CTE	α10 ⁻⁶ /°C		-1.1
Thermal Conductivity	Cal/cm.S.°C		0.372
Filament Diameter	μm		5
Cross Sectional Area	mm ²	6 000	0.11

COMPOSITE PROPERTIES*

PROPERTY	UNIT	NOMINAL VALUE
Tensile Strength	MPa (kgf/mm ²)	2010 (205)
Tensile Modulus	GPa (10 ³ kgf/mm ²)	340 (34.5)
Tensile Strain	%	0.6
Compressive Strength	MPa (kgf/mm ²)	880 (90)
Flexural Modulus	GPa (10 ³ kgf/mm ²)	280 (28.5)
ILSS	MPa (kgf/mm ²)	70 (7)

* Toray 2500 – 120°C resin system. Measured temperature: RT. Normalized to 60% fiber volume.

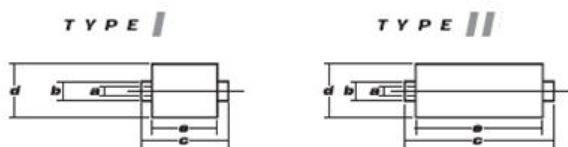
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			a	b	c	d	e		
6K	0.5	I	76	82	192	107	156	24	12

BOBBIN TYPE:



Please refer to SDS for handling and disposal.

REQUIREMENTS

Shelf Life: 24 months from month of manufacture, if stored under ambient condition

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Torayca™ M60J carbon fiber is a high modulus fiber with enhanced tensile and compressive strength. A class-leading carbon fiber in terms of mechanical properties Torayca™ M60J is able to meet mechanical performance and dimensional stability requirements of demanding aerospace applications. Manufactured in Japan.

PRODUCT DESIGNATION

M60J	B	3 000	5	0	A
Fiber Type	Twist*	Filament Count	Sizing Type	Surface Treatment	Sizing Amount

*Blank: Twisted
B: Untwisted

RESIN SYSTEM COMPATIBILITY

SIZING TYPE & AMOUNT	RESIN SYSTEM COMPATIBILITY	METHOD
50A / 50B (1%)	Epoxy, phenolic, polyester, vinyl ester	TY-QA-005

FIBER PROPERTIES

PROPERTY	UNIT	FILAMENT COUNT	NOMINAL VALUE*	METHOD
Tensile Strength	MPa (kgf/mm ²)		3820 (390)	TY-QA-002
Tensile Modulus	GPa (10 ³ kgf/mm ²)		588 (60.0)	TY-QA-002
Elongation	%		0.7	TY-QA-002
Density	g/cm ³		1.93	TY-QA-003
Yield	g/1000m	3 000	103	TY-QA-004
		6 000	206	

* Lot properties are reported as average values of a test set per bobbin sampled. The stated values are typical values. For design purposes, please contact us.

FUNCTIONAL PROPERTIES

PROPERTY	UNIT	FILAMENT COUNT	NOMINAL VALUE
Specific Heat	Cal/g.°C		0.17
Electric Resistivity	x 10 ⁻³ Ω.cm		0.7
CTE	α10 ⁻⁶ /°C		-1.1
Thermal Conductivity	Cal/cm.S.°C		0.363
Filament Diameter	μm		5
Cross Sectional Area	mm ²	3 000	0.050
		6 000	0.10

COMPOSITE PROPERTIES*

PROPERTY	UNIT	NOMINAL VALUE
Tensile Strength	MPa (kgf/mm ²)	2060 (210)
Tensile Modulus	GPa (10 ³ kgf/mm ²)	365 (37.0)
Tensile Strain	%	0.6
Compressive Strength	MPa (kgf/mm ²)	785 (80)
Flexural Modulus	GPa (10 ³ kgf/mm ²)	305 (31.0)
ILSS	MPa (kgf/mm ²)	70 (7)

* Toray 2500 – 120°C resin system. Measured temperature: RT. Normalized to 60% fiber volume.

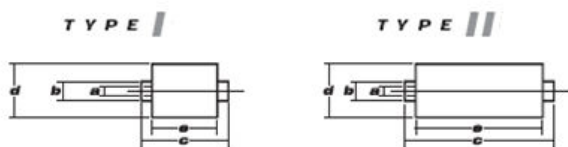
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			a	b	c	d	e		
3K	0.2	I	76	82	192	94	156	24	4.8
6K	0.4	I	76	82	192	103	156	24	9.6

BOBBIN TYPE:



Please refer to SDS for handling and disposal.

REQUIREMENTS

Shelf Life: 24 months from month of manufacture, if stored under ambient condition

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64150 ABIDOS, FRANCE

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PRODUCT DESIGNATION

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RESIN SYSTEM COMPATIBILITY

SIZING TYPE & AMOUNT	RESIN SYSTEM COMPATIBILITY	METHOD
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PROPERTY	UNIT	FILAMENT COUNT	NOMINAL VALUE
Specific Heat	Cal/g.°C		0.17
Electric Resistivity	x 10 ⁻³ Ω.cm		0.7
CTE	α10 ⁻⁶ /°C		-1.1
Thermal Conductivity	Cal/cm.S.°C		0.363
Filament Diameter	μm		5
Cross Sectional Area	mm ²	3 000	0.050
		6 000	0.10

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PROPERTY	UNIT	NOMINAL VALUE
Tensile Strength	MPa (kgf/mm ²)	2060 (210)
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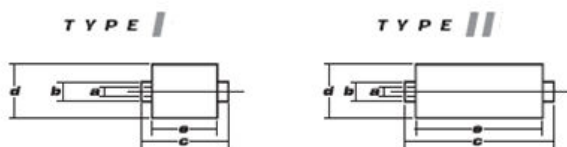
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6K	0.4	I	76	82	192	103	156	24	9.6

BOBBIN TYPE:



Please refer to SDS for handling and disposal.

REQUIREMENTS

Shelf Life: 24 months from month of manufacture, if stored under ambient condition

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64170 LACQ, FRANCE

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Route de Lagor
64150 ABIDOS, FRANCE

AQ 863

TYPICAL FIBER PROPERTIES

TORAY

Toray Carbon Fibers Europe

FIBER TYPE	NUMBER OF FILAMENTS	TENSILE STRENGTH* [MPa]	TENSILE MODULUS* [GPa]	ELONGATION* %	MASS PER UNIT LENGTH [Tex (g/1000m)]	DENSITY [g/cm ³]
FT300 / T300	1000	3530	230	1,5	66	1,76
	3000				198	
	6000				396	
T300J	3000	4210	230	1,8	198	1,78
	6000				396	
T400H	3000	4410	250	1,8	198	1,80
	6000				396	
T620SC	24000	4300	235	1,8	1850	1,77
T700SC	12000	4900	230	2,1	800	1,80
	24000				1650	
T700GC	12000	4900	240	2,0	800	1,79
T720SC	36000	5880	265	2,2	1650	1,80
T800H	6000	5490	294	1,9	223	1,81
	12000				445	
T800SC	24000	5880	294	2,0	1030	1,80
T1000G	12000	6370	294	2,2	485	1,80
T1100SC	12000	7000	324	2,0	505	1,79
	24000				1010	
T1100GC	12000	7000	324	2,0	505	1,79
	24000				1010	
M30S	18000	5490	294	1,9	760	1,73
M35J	6000	4510	343	1,3	225	1,75
	12000	4700		1,4	450	
M40	6000	2740	392	0,7	364	1,81
	12000				728	
M40J	6000	4400	377	1,2	225	1,77
	12000				450	
M46J	6000	4200	436	1,0	223	1,84
	12000	4020		0,9	445	
M50J	6000	4120	475	0,9	216	1,88
M55J	6000	4020	540	0,8	218	1,91
M60J	3000	3820	588	0,7	103	1,93
	6000				206	

*Measured using the impregnated strand test method.
This information can be used just for material selection purpose.

TORAY CARBON FIBERS EUROPE S.A.

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PLANT

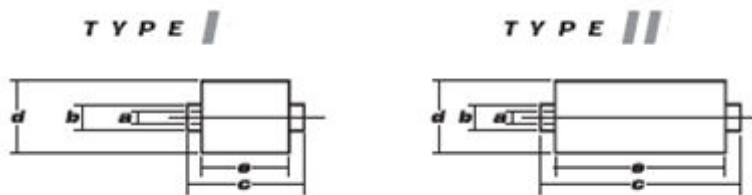
Route de Lagor
64150 ABIDOS, FRANCE

AQ 864

PACKAGE SIZE

TORAY

Toray Carbon Fibers Europe



FIBER TYPE		STANDARD PACKAGE (*)		PACKAGE SIZE (mm)					PACKING UNIT
		Fibre weight (kg)	Package type	a	b	c	**d	**e	(net weight kg)
T300	1K A/B	1.0	I	76	82	192	132	156	1.0x16=16
	3K A/B	2.0	I	76	82	192	157	156	2.0x12=24
	3K A/B	4.0	I	76	82	192	210	156	4.0x150=600
	6K A/B	2.0	I	76	82	192	157	156	2.0x12=24
T300J	3K A/B	2.0	I	76	82	192	157	156	2.0x12=24
	6K A/B	2.0	I	76	82	192	157	156	2.0x12=24
	12K C	4.0	II	76.5	82.5	280	170	252	4.0x6=24
T400H	3K A/B	2.0	I	76	82	192	157	156	2.0x12=24
	6K A/B	2.0	I	76	82	192	157	156	2.0x12=24
T620S	24K C	6.0	II	76.5	82.5	280	200	252	6.0x4=24
		8.0	II	76.5	82.5	280	220	252	8.0x90=720
T700S	12K C	4.0	II	76.5	82.5	280	170	252	4.0x6=24
		6.0	II	76.5	82.5	280	200	252	6.0x4=24
		8.0	II	76.5	82.5	280	220	252	8.0x90=720
	24K C	4.0	II	76.5	82.5	280	170	252	4.0x6=24
		6.0	II	76.5	82.5	280	200	252	6.0x4=24
		8.0	II	76.5	82.5	280	220	252	8.0x90=720
T700G	12K C	6.0	II	76.5	82.5	280	200	252	6.0x4=24
T800H	6K B	2.0	I	76	82	192	157	156	2.0x12=24
	12K B	4.0	II	76.5	82.5	280	176	252	4.0x6=24
T800S	24K C	4.0	II	76.5	82.5	280	170	252	4.0x6=24
		6.0	II	76.5	82.5	280	200	252	6.0x4=24
T1000G	12K B	2.0	II	76.5	82.5	280	140	252	2.0x12=24
M30S	18K C	4.0	II	76.5	82.5	280	170	252	4.0x6=24
M35J	6K B	1.0	I	76	82	192	126	156	1.0x16=16
	12K B	2.0	I	76	82	192	157	156	2.0x12=24
M40	1K A	0.15	I	76	82	192	91	156	0.15x24=3.6
	3K A/B	1.0	I	76	82	192	126	156	1.0x16=16
	6K A/B	1.5	I	76	82	192	143	156	1.5x12=18
	12K A/B	4.0	II	76.5	82.5	280	173	252	4.0x6=24
M40J	6K B	1.0	I	76	82	192	126	156	1.0x16=16
	12K B	2.0	I	76	82	192	157	156	2.0x12=24
M46J	6K B	1.0	I	76	82	192	126	156	1.0x16=16
	12K B	2.0	I	76	82	192	157	156	2.0x12=24
M50J	6K B	1.0	I	76	82	192	126	156	1.0x16=16
M55J	6K B	0.5	I	76	82	192	107	156	0.5x24=12
M60J	3K B	0.2	I	76	82	192	94	156	0.2x24=4.8
	6K B	0.4	I	76	82	192	103	156	0.4x24=9.6

*Contact your TORAY representative for non-standard package needs.

**These dimensions are only for information and subject to some variation.

PACKAGE SIZE

'TORAY'

Toray Carbon Fibers Europe

LABEL / BAR CODE INFORMATION

'TORAY' QUALITY CARBON FIBER TORAYCA® MADE IN FRANCE			
T700SC- 12000-F0E			
GRADE		K	
NET-WEIGHT		24.00 Kg	
BOBBINS OF	6.00 Kg	NO.OF BOBBINS	04
LOT-NO		F5121G5	
CASE-NO		109RA09	
Toray Carbon Fibers Europe, SA MADE IN FRANCE			



BCK24.0004F5121G5109RA09

1st and 2nd character: fiber type

3rd character: bobbing grade

4th to 8th character: case net weight

9th to 10th character: number of bobbins

11th to 17th character: lot number

18th to 24th character: case number

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SALES AND MARKETING DIVISION

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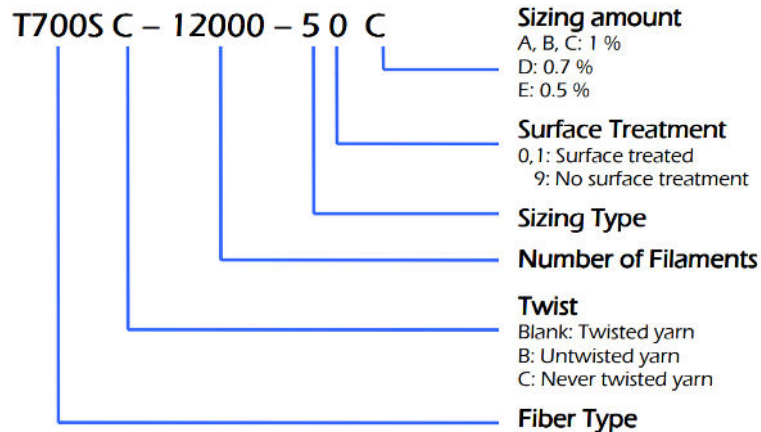
MARKING OF TORAYCA FIBER

'TORAY'

Toray Carbon Fibers Europe



THE FOLLOWING CODE SYSTEM IS APPLIED TO DESIGNATE THE STANDARD YARN PRODUCTS



1) FIBER TYPE

T700SC – 12 000 – 50C

Currently, TORAYCA fibers are separated into two main series: **T** and **M**.

The **T** series stands for tensile strength, while the **M** series indicates modulus.

Included in the **M** series are MJ type fibers, which have enhanced tensile and compressive strength properties over older **M** series fibers.

Originally, in the **T** series, the three or four digit number designated the approximate tensile strength in either kgf/mm² or ksi. For example, T700S has a tensile strength of 711 ksi.

In the case of **M** series fibers, the two digit number designates the approximate modulus in SI units. For example, M55J has a tensile modulus of 55 x 10³ kgf/mm².

The specific properties of each type of fiber can be found on data sheets

2) LOT NUMBER



3) TWIST

T700SC – 12 000 – 50C

Originally, TORAYCA fibers were produced as a twisted fiber. Because of other application requirements, TORAYCA is also produced as untwisted and never twisted fiber. Twist of the fiber is designated as follows:

(No letter) Twisted Fiber

B Untwisted Fiber (made from a twisted fiber through an untwisting process)

C Never Twisted Fiber

Please see the individual data sheets for fiber twist of each product.

4) TOW SIZE

T700SC – 12 000 – 50C

Tow sizes, or number of carbon fiber filaments per tow, vary from 1000 to 48000 filaments per tow. TORAYCA fibers are available in specific tow sized for each product. Consult the data sheets for available tow sizes.

5) SIZING

T700SC – 12 000 – 50C

TORAYCA fibers are treated with various sizing agents to enhance the handleability and bonding characteristics with various resin systems. Below are the sizing types developed for TORAYCA fibers. Not all sizing are available with every fiber. Please see the data sheets for available sizings of a particular fiber.

Sizing Type	Resin System Compatibility
1	Epoxy
2	Epoxy
3	Epoxy
4	Epoxy, phenolic, BMI
5	General purpose: Epoxy, phenolic, polyester, vinyl ester
6	Epoxy
7	Epoxy
F	Designed for vinyl ester, compatible with epoxy
9	No sizing fiber designation

6) SURFACE TREATMENT

T700SC – 12 000 – 50C

TORAYCA fibers are surface treated to enhance the adhesion properties with resin systems in a process known as oxidation. Oxygen atoms are chemically added to the surface of the fiber to increase the bonding characteristics.

The surface treatment is designated as follows:

0/1	Surface treated
9	No surface treatment

7) SIZING AMOUNT

T700SC – 12 000 – 50C

To control the handleability and adhesion properties, various amounts of sizing are applied to TORAYCA fibers. The sizing amount is designated as a letter (A to E) for a specific fiber. Because of various applications, the letter may correspond to different sizing amounts from fiber type to fiber type. See the fiber data sheet for specific sizing amounts.

TORAY CARBON FIBERS EUROPE S.A.

SALES AND MARKETING DIVISION

18 – 20 Avenue de la Porte d'Italie
75013 PARIS, FRANCE

HEAD OFFICE

Route Départementale 817
64170 LACQ, FRANCE

PLANT

Route de Lagor
64150 ABIDOS, FRANCE

AQ 870

HOW TO HANDLE BOBBINS

'TORAY'

Toray Carbon Fibers Europe

HIGH-PERFORMANCE CARBON FIBER
TORAYCA

1) HANDLING BOBBINS

6 inch bobbins (1)

Hold the 2 kg bobbin by the cardboard tube with one or two hands

1

10 inch bobbins (2)

Hold the 4 kg (or more) bobbin by the cardboard tube and outside diameter

2

2) UNFILMING BOBBINS

- Pull the thermo-retractable film along the welding (3)
- Separate each side of the film (4)
- Remove the film (5)

3

4

5

3) ADVICE

It is forbidden to handle carbon fiber bobbins using cutting tools (scissors, cutter) (6)

6

4) STORAGE OF BOBBINS BEFORE USE

The fibre shall be used after a minimum of 48 hours, conditioned between 20°C and 35°C in 40 % to 80 % relative humidity

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1) HANDLING BOBBINS

6 inch bobbins (1)

Hold the 2 kg bobbin by the cardboard tube with one or two hands

10 inch bobbins (2)

Hold the 4 kg (or more) bobbin by the cardboard tube and outside diameter

2) UNFILMING BOBBINS

- Pull the thermo-retractable film along the welding (3)
- Separate each side of the film (4)
- Remove the film (5)

1

2

3

4

5

3) ADVICE

It is forbidden to handle carbon fiber bobbins using cutting tools (scissors, cutter) (6)

6

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New AQ – Suitable applications

SUITABLE APPLICATIONS

'TORAY'

Toray Carbon Fibers Europe

FIBER TYPE	NUMBER OF FILAMENTS	Aircraft	Space	UAM	Auto motive	Defence	Marine	Pressure Vessel	Motorsport	Roller	Compound	Medical	Tooling	Civil Engineering	Sporting Goods
FT300 / T300	1000				●		●								●
	3000	●		●	●	●	●					●			●
	6000														
T300J	3000	●			●										
	6000	●													
T400H	3000	●													
	6000	●													
T620SC	24000				●										
T700SC	12000	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	24000				●	●		●		●	●			●	●
T700GC	12000	●	●	●											
T720SC	36000							●							
T800H	6000	●		●	●		●								
	12000	●			●	●	●								
T800SC	24000	●	●	●	●	●	●	●		●	●			●	●
T1000GB	12000		●		●										
T1100SC	12000				●										
	24000	●	●					●							
T1100GC	12000	●	●	●											●
	24000	●	●	●	●										
M30SC	18000				●										●
M35J	6000														●
	12000														●
M40	6000														●
	12000														●
M40J	6000			●	●		●								●
	12000	●			●		●								●
M46J	6000		●	●	●	●	●								●
	12000		●		●	●	●								●
M50J	6000														●
M55J	6000		●		●	●						●			●
M60J	3000		●												
	6000		●												●