



Document No.: NMS 818/23, Rev B, 3/21/2019

### NCAMP Material Specification

*This specification is generated and maintained in accordance with NCAMP  
Standard Operating Procedures, NSP 100*

### Carbon Fiber Tow

Teijin Carbon America (Formerly Toho Tenax)

(E-Europe Supplier Product Designation: Tenax-E HTS45 E23 3K)

(J-Japan Supplier Product Designation: Tenax-J HTS45 E23 3K)

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REVISIONS:

<b>Rev</b>	<b>By</b>	<b>Date</b>	<b>Pages Revised or Added</b>
N/C	Royal Lovingfoss	7/20/2017	Document Initial Release
A	Royal Lovingfoss	3/18/2019	Formatting, updated Toho Tenax to Teijin, added revisions table, updated Tow Tensile Modulus (Msi) specification limits using SACMA SRM16R or ASTM D4018 test method
B	Vinsensius Tanoto & Royal Lovingfoss	3/21/2019	Changed Teijin Carbon Europe GmbH address from “Boos-Fremery-Straße 62” to “Vitsstr. 2”. No change on physical building or line.

1. SCOPE

1.1 Form:

This detail specification follows the section and table numbering scheme of the base specification NMS 818. It contains additional or superseding requirements. The base specification shall govern where no additional requirement is specified; in such cases, the applicable sections are omitted from this detail specification.

3 TECHNICAL REQUIREMENTS

3.2 Material

3.2.5 Splices

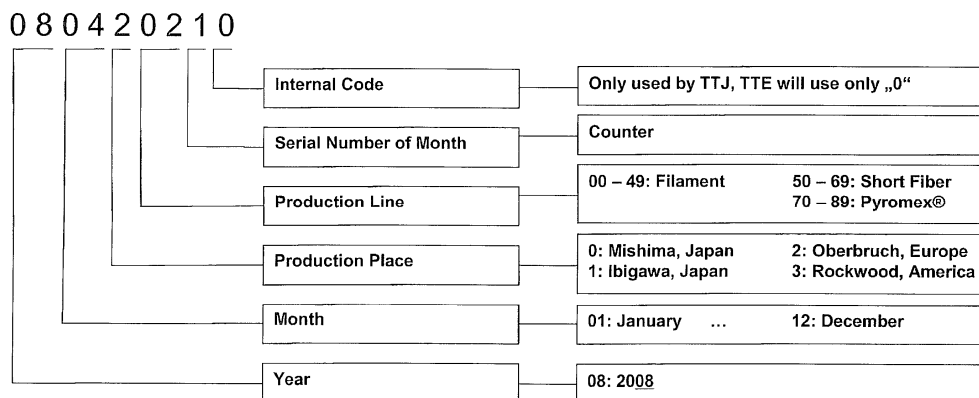
Splices are allowed for twisted tow (Style TT) only. UT and NT styles shall not be spliced. The frequency of carbon fiber tow splice shall be no more than two per pound.

3.2.9 Storage Life

Ambient storage life shall be 3 years from the date of fiber manufacture. The manufacturer shall not ship any material with less than 12 months of remaining storage life, unless specifically allowed by the purchaser.

Date of fiber manufacture (month and year) can be determined from the fiber lot number as follows:

Lot-Nummern-System



For example, lot number 080420210 indicates that the fiber is manufactured in April 2008.

3.2.10 Carbon Fiber Lot (definition)

Carbon fibers formed during one essentially continuous, uninterrupted production run under the same steady-state process conditions using unlimited PAN precursor lots. Individual carbon fiber spools must be traceable to the PAN precursor lot. An interruption in the process of up to 72 hours is permitted, provided that another material was not produced on the equipment during the interruption. Production equipment setting may be fine-tuned by the manufacturer during the production of a fiber lot only if the manufacturer is familiar with the effects of the setting on the carbon fiber properties, and for the purpose of meeting the requirements of this specification and corresponding PCD only. The fine-tuned process set-points and as-measured values must be within PCD limits.

### 3.3 Properties

The carbon fiber tow product shall conform to the requirements of Table 1.

Table 1 – Carbon Fiber Tow Properties

Paragraph	Property	Requirements, Lot average or individual spool (see Note 1)	Test Method
3.3.1	Tow Tensile Strength (ksi)	575 (min. lot average) 495 (min. ind. spool)	4.5.1
	Tow Tensile Modulus (Msi)	32.6 to 34.7 (lot average)	
3.3.2	Tow Tensile Modulus (GPa)	225 to 239 (lot average)	4.5.1 (see note 3)
	Tow Tensile Modulus (Tf/mm <sup>2</sup> )	22.9 to 24.4 (lot average)	
3.3.3	Percent Elongation	1.63 (min. lot average)	4.5.1 (see note 3)
3.3.4	Density (g/cm <sup>3</sup> ) (see Note 2)	1.73 to 1.79 (lot average)	4.5.2
3.3.5	Mass Per Unit Length (tex or g/km), without size	196 to 204 (lot average)	4.5.3
3.3.6	Twist (turns/m)	NT 0.8 per inch maximum	Not required for lot acceptance
3.3.7	Sizing Content (wt. %)	1.05 to 1.40 (lot average)	4.5.5

Note 1: Individual spool requirements are specification limits used with AQL=1%. Lot acceptance test result report may contain lot average values only; supplier shall ensure that individual spool requirements are met. Additional individual spool requirements are listed in supplier PCD.

Note 2: Density test is on reduced sampling plan and exempted from AQL of 1 percent.

Note 3: Calculation of tensile modulus/elongation according to SACMA SRM16R or ASTM D4018 test method.

#### 4.4 Change Control Approval (additional requirement)

To participate in change control management and be notified when changes occur to this specification and/or PCD, end-users must provide the appropriate contact details (name, title, company, address, e-mail, and phone) to NCAMP, Wichita State University – NIAR, 1845 Fairmount, Wichita, KS 67260-0093. All changes to PCD or subsequent documents called out in the PCD for this material should be presented to NCAMP by using the ACN process as shown in the supplier PCD. This would include but not limited to any changes to raw materials, purchasing agreements, production settings, production protocols, calibration procedures, key process parameters, key process equipment, storage, handling, shipping, or packaging, etc.

QUALIFIED PRODUCTS LIST

Supplier Product Designation	Supplier Name, Location, and Line Number	Date Qualified	Specification Callout
<p>Tenax-E HTS45 E23 3K 200 tex Sizing: 1.05 – 1.40%</p>	<p>Supplier Name: Teijin Carbon America, Inc. (Formerly Toho Tenax America, Inc.)</p> <p>Production Location: Teijin Carbon Europe GmbH Industriepark Oberbruch Vitsstr. 2 52525 Heinsberg Germany</p> <p>Line Number: 202 Only</p>	<p>7/20/2017</p>	<p>NMS 818/23, Style NT, Grade 3K</p>
<p>Tenax-J HTS45 E23 3K 200 tex Sizing: 1.05– 1.40%</p>	<p>Supplier Name: Teijin Carbon America, Inc. (Formerly Toho Tenax America, Inc.)</p> <p>Production Location: Teijin Limited Mishima Plant 234 Kamitogari Nagaizumi-cho Sunto-gun Mishima, Shizuoka 411-8720 Japan</p> <p>Line Number: 006 only</p>	<p>7/20/2017</p>	<p>NMS 818/23, Style NT, Grade 3K</p>