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NCAMP Material Specification

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

265°F Vacuum Bag Cure, Epoxy Prepregs, Type 42, Class 2, Grade 193, Style  
12K-193- SFP-OSI  
(TenCate Advanced Composites USA, Inc. TCAC12k HTS SFP OSI/TC250)

Prepared by: Yeow Ng, John Tomblin, David Ostrodka, Vinsensius Tanoto

Reviewed by: Barry Meyers (TenCate), Royal Lovingfoss (NCAMP)

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**1. SCOPE:****1.1 Form:**

This detail specification along with the base material specification NMS 688 establishes the requirements for carbon fiber fabric impregnated with a modified B-staged epoxy resin (“fabric prepreg”). The prepreg is produced using a hot-melt process.

This detail specification follows the section and table numbering scheme of the base specification. 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.

**1.3 Classification:** All products qualified to this detail specification have the following classification: Type 42, Class 2, Grade 193, Style 12K-193-SFP-OSI

**3. TECHNICAL REQUIREMENTS:**

Table 1 – Prepreg Physical and Chemical Properties

Property	Test Method <sup>(1)</sup>	Number of Replicates	Requirements <sup>(3)</sup>
Resin Content	ASTM D 3529	Every roll <sup>(2)</sup>	42 ± 3% ind. 42 ± 2% avg.
Fiber Areal Weight	ASTM D 3776 or SACMA SRM 23R-94	Every roll <sup>(2)</sup>	193 ± 9 gsm ind. 193 ± 8 gsm avg.
Volatile Content	ASTM D 3530	First and last rolls of every batch <sup>(2)</sup>	1.0% max, ind. 0.5% max, avg.
Flow	ASTM D 3531	First and last rolls of every batch <sup>(2)</sup>	22 ± 4% avg.
Gel Time	ASTM D 3532	Optional	8 ± 4 minutes, ind.
Tack	See 4.6.1	First and last rolls of every batch	Level IV, ind
Drape	See 4.6.2	First and last rolls of every batch	Pass, ind
HPLC <sup>(4)</sup>	SACMA SRM 20R-94	Optional	P1/P2 = 0.30 to 0.50, P1/P3 = 0.75 to 1.05, ind
FTIR <sup>(5)</sup>	ASTM E 168 ASTM E 1252	First and last rolls of a batch	P1/P2 = 2.71 to 2.81, P1/P3 = 0.85 to 1.07, P1/P4 = 0.96 to 1.18, ind
Differential Scanning Calorimetry (DSC) exotherm peak temperature total heat of reaction	SACMA SRM 25R-94	Optional	148±5°C, ind.

- (1) Specific procedures should be identical to those used in the original material qualification program
- (2) Three specimens should be taken across the width of the prepreg; left, center, right
- (3) "ind." refers to individual measurements. "avg" refers to the average of measurements per roll. Limits computed at  $\alpha=0.01$  and modified CV.
- (4) HPLC key peak > 12 Area %, P1 = 2.6 - 2.9 min, P2 = P1 + (1.50 ± 0.15) min, P3 = P1 + (2.50 ± 0.15).
- (5) FTIR key peaks at ± 5 cm<sup>-1</sup>, P1 = 1244, P2 = 1610, P3 = 1510, P4 = 831.

**3.2 Constituent Material Requirements:**

3.2.2 Carbon Fiber Tow: The carbon fiber tow shall be qualified to NMS 818/14.

3.2.3 Carbon Fiber Fabric: TenCate Advanced Composites Raw Material Specification, TCRMS 0401136.

**3.5 Laminate (Cured Prepreg) Requirements:**

3.5.2 Cured Laminate Physical Properties:

TABLE 3 - Cured Laminate Physical Properties

Property	Test Method <sup>(1)</sup>	Requirements <sup>(2)</sup>
Cured Ply Thickness <sup>(3)</sup>	SACMA SRM 10R-94	Between 0.0081 and 0.0090 inch avg
Dry Glass Transition Temperature, Tg by DMA	ASTM D7028	Between 241.26°F and 277.26°F ind

- (1) Specific procedures should be identical to those used in the original material qualification program.
- (2) "ind" refers to individual measurements. "avg" refers to the average measurements per panel. Limits computed at  $\alpha=0.01$  and modified CV.
- (3) Computed from actual qualification panel thicknesses.

3.5.3 Cured Laminate Mechanical Properties:

TABLE 5 - Required Cured Laminate Tests for Mechanical Properties (Class 2)

Property	Test Method <sup>(1)</sup>	Requirements <sup>(3)</sup>
0° (warp) Tension Strength and Modulus, Room Temperature, Ambient Layup: [0] <sub>12</sub>	ASTM D3039	Strength <sup>(2)</sup> : Min. Ind. ≥ 100.52 ksi Strength <sup>(2)</sup> : Average ≥ 119.29 ksi Modulus <sup>(2)</sup> : Between 8.18 and 9.70 msi avg
90° (fill) Compression Strength and Modulus, Room Temperature, Ambient Layup: [90] <sub>12</sub>	ASTM D6641	Strength <sup>(2)</sup> : Min. Ind. ≥ 63.68ksi Strength <sup>(2)</sup> : Average ≥ 75.4 ksi Modulus <sup>(2)</sup> : Between 7.55 and 8.91 msi avg
0° (warp) Short Beam Strength, Room Temperature, Ambient Layup: [0] <sub>32</sub>	ASTM D2344	Strength: Min. Ind. ≥ 7.52 ksi Strength: Average ≥ 8.68 ksi

<sup>(1)</sup> Specific procedures should be identical to those used in the original material qualification program.

<sup>(2)</sup> Normalize the properties to a cured ply thickness value of 0.0085 inch, based on actual qualification panel thicknesses.

<sup>(3)</sup> “ind.” refers to individual measurements. “avg” refers to the average of 5 replicates. Limits computed at α=0.01 and modified CV.

QUALIFIED PRODUCTS LIST

Supplier Product Designation	Supplier Name and Production Location	Date Qualified	Specification Callout <sup>(1)</sup>
TCAC12k HTS SFP OSI/TC250 TCAC#50123988	Supplier Name: TenCate Advanced Composites USA, Inc.  Production Location: 18410 Butterfield Blvd. Morgan Hill, CA 95037 USA	September 2016	NMS 688/2  Classification callout is optional because Type 42, Class 2, Grade 193, Style 12K-193-SFP-OSI is the only classification allowed in this QPL.

<sup>(1)</sup> In accordance with NCAMP Standard Operating Procedures, NSP 100, this QPL shall not contain alternate materials/products. Additional production location may be included in the QPL only after successful equivalency demonstration and approval per NCAMP Prepreg Process Control Document (PCD) Preparation and Maintenance Guide, NRP 101.

<sup>(1)</sup> The proper specification callout for material procurement purpose is “NMS 688/2.” This specification is developed based on the material properties that are available publicly. The purchaser may specify additional requirements beyond those specified in this specification, especially when the purchaser has generated additional material properties beyond those available publicly or when the application requires additional requirements. The additional requirements are subject to supplier review and approval.