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NCAMP Material Specification

High Temperature Consolidation, Medium Toughness PEEK thermoplastics

Teijin Tenax™-E TPWF/TPCL PEEK

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## REVISIONS:

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-	Kim-Leng Poon	6/22/2016	Initial release
A	Kim-Leng Poon	10/7/2021	Added Appendix: Visual inspection on consolidated laminate
B	Kim-Leng Poon	2/2/2023	Revision table was added. Table 1: Changed thicknesses requirement for Semipreg as (Optional), with 10 measurement per lot/batch, and caliper as instrument for thickness measurement. Revised butt joint or overlap determination figure in page 28

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## 1. SCOPE:

### 1.1 Form:

This specification and its associated detail specifications establish the requirements for continuous fiber unidirectional and fabric impregnated with a PEEK (Evonik Vestakeep 2000 FP) thermoplastic resin (“unidirectional tape and fabric semipreg”) and its consolidated laminate form.

### 1.2 Application:

These composite semipreg material systems are intended for use in the fabrication of aerospace structures and tooling substrate. These materials are designed specifically for high heated consolidation (autoclave or press).

### 1.3 Classification: Each detail specification has a unique classification. Semipregs shall be classified to the following Types, Classes, and Grades or Styles:

#### 1.3.1 Type shall specify nominal semipreg resin content. For example,

Type 36 – Nominal resin content 36 percent by weight  
Type 42 – Nominal resin content 42 percent by weight

#### 1.3.2 Class shall specify semipreg product form. For example,

Class 1 – Unidirectional semipreg tape  
Class 2 – Woven semipreg fabric  
Class 3 – Consolidated laminate

#### 1.3.3 Grade shall specify nominal fiber areal weight in grams per square meter (gsm). For example,

Grade 145 – 145 gsm nominal fiber areal weight  
Grade 193 – 193 gsm nominal fiber areal weight  
Grade 284– 284 gsm nominal fiber areal weight

#### 1.3.4 Style shall specify the woven fabric style (as applicable) and fiber type. For example,

Style HTS40 3K-PW (standard modulus 3K, plain weave)  
Style HTA40 3K-5HS (standard modulus 3K, 5-harness satin weave)  
Style HTS45 12K-UD (standard modulus 12K, UD tape)

### 1.4 Safety – Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address all the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

### **1.5 Rounding of Values:**

The following applies to all specified limits or requirements in this specification. For purposes of determining conformance with this specification, an observed value or a calculated value shall be rounded “to the nearest unit” in the last right-hand digit used in expressing the specification limit, in accordance with the rounding method of ASTM E29.

### **1.6 Qualified Products:**

This specification requires qualified products. Qualified products are listed in the Qualified Products List (QPL) of each detail specification. In accordance with the requirements of this specification, the specific fiber material and source(s), weaver(s), and the specific resin components and source(s) shall be qualified as a semipreg material system. Any other combinations not listed on the QPL of the detail specification are not qualified. In addition, the production of the qualified products is controlled by an NCAMP approved process control document (PCD) as specified in 3.11.

### **1.7 Detail Specification:**

This base specification contains basic fiber reinforced thermoplastic semipreg material requirements that apply to every product. The detail specifications contain additional or superseding properties and requirements that apply to a specific product.

### **1.8 Change Control Approval:**

Semipreg product shall be produced in accordance with an NCAMP approved Process Control Document (PCD). Formal change notification and approval is required before a change may be implemented. In general, level 1 through level 3 changes per DOT/FAA/AR-07/3 are considered major changes. NCAMP approval is required for major changes, and is granted through Advance Change Notices (ACN). Prior to implementing a major change, the material supplier shall contact NCAMP with the following information:

- a. A detailed description of the change,
- b. A draft test plan to substantiate that the change will not affect the semipreg material properties, and

## **2. APPLICABLE DOCUMENTS**

The latest issue of the NCAMP publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order unless otherwise specified. When a referenced document has been canceled and no superseding document has been specified, the last published issue of that document shall apply.

**2.1 NCAMP Publications:**

NMS 818	Carbon Fiber Tow
NRP 101	Prepreg Process Control Document (PCD) Preparation Guide
NPS 84013	Fabrication of NMS 401 Qualification, Equivalency, and Acceptance Test Panels, Teijin Tenax®-E TPWF/TPCL PEEK

**2.2 ASTM Publications** (available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, <http://www.astm.org>)

ASTM D3039	Tensile Properties of Polymeric Matrix Composite Materials
ASTM D3171	Standard Test Methods for Constituent Content of Composite Materials.
ASTM D3418	Standard Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry.
ASTM D3518	Standard Test Method for In-Plane Shear Response of Polymer Matrix Composite Materials by Tensile Test of a $\pm 45^\circ$ Laminate.
ASTM D3529	Standard Test Methods for Constituent Content of Composite Prepreg
ASTM D3776	Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
ASTM D3878	Standard Terminology Composite Materials
ASTM E29	Using Significant Digits in Test Data to Determine Conformance with Specifications

**2.3 ISO Publications:**

ISO 9000	Quality Management Systems
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**2.4 US Government Publications:**

29 CFR 1910.1200	Hazard Communication, Occupational Safety and Health Standards
DOT/FAA/AR-06/10	Guidelines and Recommended Criteria for the Development of a Material Specification for Carbon Fiber/Epoxy Fabric Prepregs
DOT/FAA/AR-07/3	Guidelines and Recommended Criteria for the Development of a Material Specification for Carbon Fiber/Epoxy Unidirectional Prepregs Update
MIL-D-3464	Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification
CMH-17	Composite Materials Handbook (formerly MIL-HDBK-17)

**2.5 European Standards:**

DIN EN 2557:1997	Carbon fiber preimpregnates. Determination of mass per unit area
DIN EN 2559:1997	Carbon fiber preimpregnates. Determination of the resin and

DIN EN ISO 11357-7 fiber content and the mass of fiber per unit area  
 Plastics - Differential scanning calorimetry (DSC) - Part 7:  
 Determination of crystallization kinetics

**3. TECHNICAL REQUIREMENTS:**

**3.1 Detail Specification:**

The requirements for a specific fiber reinforced unidirectional tape and fabric thermoplastic semipreg product shall consist of all requirements specified herein in addition to requirements specified in the applicable detail specification. In case of conflict between requirements of this basic specification and an applicable detail specification, requirements of the detail specification shall govern.

**3.2 Constituent Material Requirements:**

Material supplied in accordance with this specification shall consist of thermoplastic resin and fiber.

**3.2.1 PEEK Resin polymer (Evonik Vestakeep 2000 FP):**

The polymer shall be a thermoplastic-based resin that is capable of meeting the requirements of this specification; no separate specification exists for the resin system. Any changes to the thermoplastic resin system since qualification shall be re-approved by NCAMP. No more than two resin batch shall be included in any single semipreg batch unless allowed by the detail specification or accepted by the purchaser in the purchase order. At some point, the batch has to be powder coated with a maximum two different lots of powder on each side when one powder lot has depleted.

**3.2.2 Reinforcement:** The reinforcement requirements shall be specified in the applicable detail specifications.

**3.3 Semipreg Physical and Chemical Property Requirements:**

**3.3.1 Semipreg physical and chemical properties:**

The semipreg material shall meet the physical and chemical property requirements of Table 1 and as specified below. The material shall be capable of being cut without disarray of the filaments and without other visible damage.

Table 1 – Semipreg Physical and Chemical Properties (Class 2)

Property	Product Form	Test Method <sup>(1)</sup>	Number of Replicates
Semi-preg Areal Weight	Semipreg	EN 2557 or ASTM D3776	Each Lot/Batch <sup>(2)</sup>
Fiber Areal Weight	Semipreg	EN 2557 or ASTM D3529 <sup>(4)</sup>	Each Lot/Batch <sup>(2)</sup>



TP Weight Content	Semipreg	EN 2559 <sup>3</sup> or ASTM D3529 <sup>(4)</sup>	Each Lot/Batch <sup>(2)</sup>
Thickness <sup>(5)</sup> (Optional)	Semipreg	ASTM D3171	10 Measurements Each Lot/Batch <sup>(2)</sup>
Differential Scanning Calorimetry (DSC)		DIN EN ISO 11357-7 or ASTM D3418	
-Melting Temperature	Semipreg		Each Lot/Batch <sup>(2)</sup>
-Degree of Crystallinity			

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

<sup>(2)</sup> Refer to Table 4 for sampling requirement. Three specimens minimum should be taken across the width of each Lot/Batch.

<sup>(3)</sup>  $(w1-w2)/w1*100$ , where w1 equals to semipreg areal weight (PAW) and w2 fiber areal weight without sizing (FAW)

<sup>(4)</sup> Matrix Acid digestion w/ASTM D3171 Procedure B

<sup>(5)</sup> Use caliper for thickness measurement.

**3.4 Visual and Dimensional Requirements:**

**3.4.1 General:**

The semipreg shall be uniform in quality and shall not contain defects detrimental to handling, layup, consolidating or structural properties.

3.4.1.2 **POWDER COATED FABRIC LOT:** The set of powder coated fabric rolls coming from 1 powdering production order and coming from only 1 loom-state fabric lot. The lot has to be powder coated with a maximum of two different lots of powder on each side. No interruption by another production can be made during the production of a powder coated fabric lot. The maximum production time for one batch is 300 hours, all times stops included. During this process no stoppage period longer than 60 hours. All the stops are imperatively made at the end of a complete roll. Several stop are authorized during one batch.

**3.4.2 Visual Requirements (Class 1):**

3.4.2.1 The semipreg material shall be free from foreign material, cut or broken fibers, wrinkles, polymer-dense areas and indications of moisture visible to the unaided eye.

**3.4.2.2 Fuzz balls shall be acceptable provided:**

- a. The fuzz balls cause no apparent fiber distortion. This shall be determined without removing the fuzz balls.
- b. Any fuzz ball shall not exceed 1.5 inches in any direction.
- c. The accumulated number of fuzz balls shall not exceed 6 in any 10 square feet of one side of semipreg material.
- d. The overall thickness change due to fuzz ball is no more than 50 percent of the semipreg material nominal thickness.

- 3.4.2.3 The edge of the semipreg tape shall not deviate from a straight line by more than 0.025 inch per foot of length and shall be flush with the separator paper.
- 3.4.2.4 All fiber tows shall be collimated and parallel, within 0.025 inch per foot of length, to the centerline of the material.
- 3.4.2.5 The length of fiber gap, parallel to the 0° direction, shall not exceed 10 inches. The width of fiber gap, perpendicular to the 0° direction, shall not exceed 0.030 inch. One gap 0.010 to 0.030 inch wide and not exceeding 10 inches long is acceptable in each 10 square feet of semipreg. Gaps less than 0.010 inch wide and not exceeding 10 inches long are acceptable.
- 3.4.2.6 The semipreg shall be free from crimped fibers and fiber tow crossovers visible to the unaided eye.

3.4.3 Visual Requirements (Class 2)

- 3.4.3.1 The semipreg material shall be free from foreign material, cut or broken fibers, folded selvages that overlap non selvage areas, wrinkles or polymer-dense areas and indications of moisture visible to the unaided eye. Areas that are not coated with PEEK polymer shall not exceed .50” in diameter.
- 3.4.3.2 The warp yarns shall be parallel to the warp direction within 1.0 inch over any 21.0 inches, visible to the unaided eye.
- 3.4.3.3 The fill yarns shall be perpendicular to the warp direction within 5% over any 50.0 inches.

3.4.4 Visual Requirements (Class 3):

- 3.4.4.1 Please refer to Appendix for laminate defects.

3.4.5 Roll characteristics:

The total weight or length of material shall be specified by the purchaser. Unless otherwise specified by the purchaser, individual roll net weight shall not exceed 267 pounds for Class 1 and Class 2 materials, respectively. The standard roll length is at 200m. Width shall be as specified by the purchaser. Unless otherwise specified by the purchaser, tolerances on the width of the semipreg shall be:

- a. For unidirectional tape widths greater than 12.0 inches: +/-0.060 inch
- b. For unidirectional tape widths of 12.0 inches: +/-0.030 inch
- c. For unidirectional tape widths less than 12.0 inches: +/-0.020 inch
- d. For woven fabric (excluding the selvages): +/-1.000 inch

### 3.4.6 Material not conforming to the visible defect limitations and dimensional requirements:

- 3.4.6.1 In cases where foreign material can be removed without causing any apparent deformation of the semipreg surface, they may be removed by spatula or adhesive tape. The spatula or adhesive tape shall not transfer any contaminants to the semipreg product.
- 3.4.6.2 Areas not conforming to Section 3.4.1, 3.4.2, or 3.4.3 shall be identified along the edge of the semipreg roll by markers. Markers shall be distinguishable from the semipreg and carrier release paper and removable without damaging the semipreg material.
- 3.4.6.3 For single-point defects, use a single marker.
- 3.4.6.4 Successive single-point defects 3 feet or less apart shall be considered as one continuous defect. For continuous defective areas, markers shall be placed at the beginning, at each 2-foot maximum interval, and at the end of the continuous defect.
- 3.4.6.6 Semipreg material roll shall have a maximum defect content of 15 percent by weight or length. The defect weight limit shall be based on full-width weight.
- 3.4.6.7 The semipreg rolls have no splice provision. Any defects that may exist in the semipreg are marked within the laminate product.
- 3.4.6.8 The type, location, and length (for continuous defect) of each marked defect, and the location of the splices shall be indicated on a defect log accompanying each roll of semipreg material.

### 3.5 Laminate (Consolidated Semipreg) Requirements:

#### 3.5.1 Test Laminate Fabrication and Baseline Consolidating Process:

The test laminate fabrication and baseline consolidating process shall be in accordance with NCAMP Process Specification NPS 84013 Fabrication of NMS 401 Qualification, Equivalency, and Acceptance Test Panels. In order to facilitate individual specimen traceability, individual specimen numbering and/or skewed lines must be written or drawn across each sub-panel as shown in Figure 1.

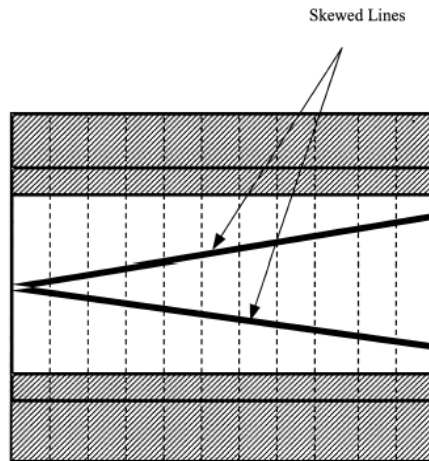


Figure 1 – Specimen Traceability Line

### 3.5.2 Consolidated Laminate Physical Properties:

The consolidated laminate physical properties listed in Table 2 shall conform to the values and limits listed on the corresponding detail specification.

TABLE 2 - Consolidated Laminate Physical Properties (Class 3)

Property	Test Method	Number of Replicates
DSC (dry) <sup>(1)</sup> -Melting Temperature -Degree of Crystallinity	DIN EN ISO 11357-7 or ASTM D3418	2 per batch/lot minimum
Visual	NMS 401 Base Material Spec (Section 9.1)	Each laminate
NDI Health Control	(ASTM E1316, ASTM E2580 & NAS 410) or 39.P02.040.04	Each laminate
Consolidation Ply Thickness, CPT	ASTM D3171	25 measurements per panel (points) for an 800 X 1200mm
Laminate Density	ASTM D792	2 per batch/lot minimum
Fiber Volume, % by Volume	ASTM D3171	2 per batch/lot minimum
Resin Content, % by Weight	ASTM D3171	2 per batch/lot minimum
Void Content, % by Volume	ASTM D3171	2 per batch/lot minimum

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

3.5.3 Consolidated Laminate Mechanical Properties:

The consolidated laminate mechanical properties listed in Table 3, shall conform to the values and limits listed on the corresponding detail specification.

TABLE 3 - Required Consolidated Laminate Tests for Mechanical Properties (Class 2 and Class 3)

Property	Test Temperature	Test Method <sup>(1)</sup>	Number of Replicates
0° Tension Strength and Modulus <sup>(2)</sup>	RT	ASTM D3039	5
IPS Strength and Modulus <sup>(2)</sup>	RT	ASTM D3518	5

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

<sup>(2)</sup> Teijin is to supply [0°]4s panel for purchaser’s receiving inspection if laminate is purchased. Standard release will include physical and mechanical testing. Customer to purchase panel for additional testing, as applicable or direction from Teijin.

### **3.6 Storage and Handling Requirements:**

#### **3.6.1 General Requirements:**

##### **3.6.1.1 Release Paper/poly Film (Optional):**

A non-transferring separator paper with differential release may be used on the inside of the roll. Paper or release film shall be used on the outside of the roll to permit easy removal of the preimpregnated material from the roll without tearing, shredding, fiber realignment, or other damage. The material shall be capable of being cut cleanly without other visible damage. The release paper shall not contaminate the semipreg.

##### **3.6.1.2 Material Handling:**

All rolled material shall be package in a heavy double walled cardboard box or equivalent. No more than 2 boxes per banded pallet and only stack one row high. The fiberboard tube does not require to extend past the semipreg. The material shall not be allowed to rest in a vertical position. Core size shall be 3.0" diameter minimum.

#### **3.6.2 Semipreg Life Requirements:**

**3.6.2.1 Storage Life:** The semipreg rolls is wrapped with PE film, place within a suitable box to prevent UV light degradation in a clean and dry area. The semipreg rolls shall be kept horizontal, and shall not have any heavy objects resting on top of it.

**3.6.2.1.1** The semipreg shall have a shelf life of six years (unverified) when stored in accordance with the conditions above at the temperature recommended by the manufacturer. It must be stored in a manner to prevent exposure to UV light sources in an environment 5-30°C (40-86°F) and less than a 50% relative humidity. Direct exposure to sunlight or rain shall also be avoided to prevent loss in performance.

**3.6.2.1.2** The semipreg does not required any special environmental condition during the molding process, normal shop floor condition 5-30°C (40-86°F) and less than a 65% relative humidity. In clean work environment, shall be from free from dust and contaminants. The semipreg work life is 2 years (unverified) under normal shop floor condition, with proper storage and no UV exposure.

**3.6.2.1.3** For purposes of tracking the shelf life, the time shall be measured from the date of manufacture, unless otherwise specified in the purchase order. Material that has been stored for a time period longer than the maximum shelf life shall not be used until tests have been performed to extend the storage life as defined by 3.6.2.1.4 or the user's process specifications.

**3.6.2.1.4 Shelf Life Extension:** Shelf life may be extended by the purchaser. Storage life extension requirement is similar to receiving inspection requirement in 4.5. Each extension is 6 months (unverified).

### 3.6.3 Distributors:

A material distributor shall perform the same documentation of storage life and handling life as the purchaser. If the original packaging is to be opened to allow for re-spooling into smaller units.

## 3.7 Environmental, Health, and Safety:

3.7.1 Equipment, materials, solutions, and emissions (if applicable) shall be controlled, handled, used, and disposed of in accordance with all local, State, and Federal Government Safety, Health, and Environmental Affairs (SHEA).

3.7.2 The delivered semipreg system shall fulfill the local requirements of the health and safety laws of the country of the purchaser. When processing the semipreg in the composite shop, there shall be no health hazards or emissions that require special measures to be taken to protect the environment.

3.7.3 The manufacturer shall inform the purchaser about the safe handling procedures of the material. The Material Safety Data Sheet (MSDS) or equivalent (TDS or SUI) shall be made available to the purchaser.

## 3.8 Defects During Usage:

3.8.1 Defects, as defined by this specification, found in the semipreg material after acceptance shall be cause for rejection and the defective material shall be returned to the supplier. Defects caused by user mishandling or improper storage are not the responsibility of the supplier and shall not be cause for rejection back to the supplier.

## 3.9 Qualification Requirements:

Materials shall be qualified in accordance with an NCAMP test plan.

## 3.10 Material Re-Qualification and Equivalency:

3.10.1 If any change occurs relevant to this specification or the PCD, NCAMP reserves the right to require a re-qualification by the semipreg manufacturer to validate that the changed material is equivalent to the material in the initial qualification. The extent of the re-qualification program will depend on the nature of the change of the material or the material processing. DOT/FAA/AR-06/10 and DOT/FAA/AR-07/3 provide guidance in this area.

3.10.2 Equivalency is limited to the evaluation of minor changes in a material's constituents, manufacturing process, or fabrication (e.g. molding) process used with a material. Significant changes to the semipreg material will require a full qualification program and a separate specification.

3.10.3 It is the responsibility of the material supplier to conduct testing to demonstrate that the

current material, when processed to the baseline process specification, will generate composite properties statistically equivalent to the properties of the original materials.

### **3.11 Process Control Document:**

- 3.11.1 The supplier shall prepare and control a Process Control Document (PCD) in accordance with NRP 101. The PCD shall be considered proprietary and shall be protected in accordance with disclosure agreements signed by the supplier and NCAMP. The established Process Control Document (PCD) shall be presented to NCAMP upon request. NCAMP shall treat any information contained in the PCD as proprietary.
- 3.11.2 Changes to the PCD of a qualified material (as defined by DOT/FAA/AR-06/10, DOT/FAA/AR-07/3, and NRP 101) are subject to the written approval of NCAMP. Such changes may require substantial testing.

### **3.12 Traceability:**

Each individual material and its constituents as defined by the PCD shall be identifiable at all stages of manufacture and delivery. The material manufacturer shall present evidence of the material traceability upon request.

### **3.13 Manufacturer's Responsibility:**

- 3.13.1 The manufacturer is responsible for the development and manufacture of any material submitted in accordance with this specification. Quality control by the manufacturer shall be in accordance with this specification.
- 3.13.2 Changes to the semipreg require review and approval by NCAMP in accordance with 1.8. Any testing required to validate the changes or adjustment of manufacturing materials, techniques and/or procedures is the manufacturer's responsibility.

### **3.14 Quality Management System:**

The manufacturer's quality system shall be approved as defined in ISO 9000 or equivalent.

## **4. QUALITY ASSURANCE:**

### **4.1 Responsibility for Inspection:**

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all batch release inspection and test requirements specified herein and the purchaser is responsible for the performance of all receiving inspection tests specified herein. The supplier may use their own facilities or any commercial laboratory



acceptable to NCAMP. The purchaser or NCAMP reserves the right to perform additional tests to assure that the material furnished conforms to the prescribed requirements.

## **4.2 Classification of Tests and Inspections:**

### **4.2.1 Qualification Tests:**

The preproduction tests performed for material qualification are those tests performed on representative samples of each specific form of material to establish a qualified product in accordance with this specification. Qualification testing shall be in accordance with an NCAMP test plan.

### **4.2.2 Batch Release Tests:**

Batch release tests shall be those tests performed by the supplier on representative samples taken from each production batch of each type of material submitted by the supplier for acceptance under contract or purchase order. Specification limits are specified in the detail specification. Data and certification of data generated shall accompany each shipment of material.

#### **4.2.2.1 Additional Testing:**

The purchaser reserves the right to perform additional testing to confirm the supplier's certification data, and to approve incoming material for use in the fabrication of production parts. Each roll of material may be examined by the purchaser for appearance, color uniformity, imperfections which would be detrimental for use in the fabrication of parts, and for quality of workmanship.

### **4.2.3 Receiving Inspection Tests:**

The receiving inspection tests shall be those tests performed by the purchaser or approved test lab on representative samples taken from each production batch/lot of each type of material delivered by the supplier.

## **4.3 Supplier Statistical Process Control:**

The supplier shall establish and maintain procedures and requirements for an SPC system based on Key Characteristics (KC) and Controlled Process Parameters (CPP). The KC are the material properties required for batch release per 4.4.1. The KC monitoring, typically using control charts, must be provided to material users, certification agencies, and NCAMP staff upon request. The CPP monitoring must also be provided to material users, certification agencies, and NCAMP staff upon request, but proprietary information may be coded or normalized. Alternatively, supplier may send the KC data to NCAMP for inclusion in the NCAMP's control charts which are available to the public.

**4.4 Product Certification:**

4.4.1 Batch Release Tests:

The supplier shall perform batch release tests on each batch of semipreg as specified in this section and the detail specification.

4.4.1.1 Semipreg Physical and Chemical Properties: Test in accordance with the requirements of Table 1 and the detail specification.

**TABLE 4 - Supplier Quality Control Sampling Plan for Fabric/Semi-preg Properties**

Number of Rolls (in lot)	Test Frequency for Batches Shipped
1 to 3	1 roll
4 to 15	2 rolls
16 to 25	3 rolls
26 to 40	4 rolls
41 to 65	5 rolls
66 to 99	6 rolls
≥ 100	7 rolls

4.4.1.2 Laminate Physical Properties: Test in accordance with the requirements of Table 2 and the detail specification.

4.4.1.3 Laminate Mechanical Properties: Each batch of semipreg shall be tested to verify compliance with the mechanical property requirements in Table 3 of the applicable detail specification. Each lot will be mechanically tested, first & last roll.

4.4.2 Certification of Conformance

The supplier shall furnish with each shipment one copy of a Certification of Conformance including certified test reports, confirming that all the material in the shipment complies with the requirements of this specification. The Certificate of Conformance shall include the following information:

- a. Manufacturer’s identification.
- b. Manufacturer’s material designation.
- c. Specification number, title, revision.
- d. Purchase order number.
- e. Date, type, roll numbers and results of batch release tests, including actual individual test data and average values.
- f. Results of any retests.
- g. Semipreg batch numbers.
- h. Lot numbers of fiber, fabric, and resin used in the manufacturer of the Semipreg materials.
- i. Date of manufacture (date of impregnation).
- j. Fiber lot certification test data and certificate of conformance to NMS 818.

- k. List of roll numbers for each batch and the quantity (length or weight) of each roll.
- l. Roll defect logs.

4.4.3 Records: The following records shall be available for inspection by NCAMP and purchasers

4.4.3.1 The supplier shall keep on permanent file all records pertaining to the qualification of the candidate material.

4.4.3.2 The supplier shall keep the following records on file, for each semipreg batch, for a minimum period of 10 years:

- a. Full semipreg batch traceability. This traceability shall extend to the particular resin and resin component batches, and fiber yarn lot(s) employed, where applicable.
- b. All records pertaining to raw material receiving inspection and certification, in-process records, and product testing specified in the supplier PCD.
- c. All records pertaining to the SPC requirements which are specified in the supplier PCD.

**4.5 Receiving Inspection:** Before the semipreg material is accepted, the purchaser shall perform the following:

4.5.1 Verification: Material shall be inspected to assure that:

- a. The material identification is correct.
- b. The quantity is correct.
- c. The required test data is received.
- d. The Certificate of Conformance is received.

4.5.2 Testing:

The purchaser shall repeat the supplier batch release test per 4.4.1 as part of the receiving inspection tests on each batch/lot of semipreg. As use and confidence increase, the receiving inspection testing may be modified based on proven performance in cooperation with the material supplier, customer (if purchaser is supplying composite parts to another aircraft company), and appropriate certification agency.

4.5.3 Re-Testing:

One retest is allowed for each test property. Additional re-test(s) is allowed only when one or more of the following conditions exist:

- a. The initial test was performed in significant deviation to the appropriate procedure. Significant deviations are those expected to affect the measured response.
- b. In the course of layup, consolidating, machining, or testing, there was an occurrence known to cause or contribute to the observed test result(s).

- c. Standard statistical analysis procedures establish the suspect individual data point(s) as an outlier and there is a probable, if not provable, relationship to a deviation from required procedure.

## **5. PREPARATION FOR DELIVERY:**

### **5.1 Packaging:**

- 5.1.1 The semipreg shall be rolled onto a core suitable for use at the purchaser. Suppliers uncertain as to core suitability shall direct their inquiries through the purchaser prior to fabrication of material.
- 5.1.2 Each spool/roll of material is wrapped with PE film, place within a designated box to prevent UV light degradation. The semipreg rolls shall be supported at all times by the ends of the internal fiberboard tube and kept horizontal.
- 5.1.3 The individual spool or roll shall be packed in a shipping container that will be acceptable for safe transportation by common carriers and shall include a packing list. The core shall be supported on ends to avoid damage to the semipreg. The container shall be of such design as to prevent damage or degradation to the semipreg during shipment.
- 5.1.4 The outside of each container and the inside of the roll core shall be clearly marked with the following information:
  - a. Title, number and revision letter of this specification, (and the PCD if required by the detail specification).
  - b. Date of manufacture (or date of shipment if specified by the detail specification)
  - c. Linear feet of acceptable semipreg
  - d. Purchase order number and/or sales order number (not required on roll core)
  - e. Supplier's name
  - f. Supplier's semipreg batch and spool/roll number
  - g. A statement (not required on roll core) to indicate that:
    - (1) The container should not stand on end (for semipreg wider than 12 inches only)
  - h. All material labeling shall comply with OSHA Hazard Communication, 29 CFR 1910.1200.
- 5.1.5 If spools/rolls are reused, all information not applicable to the current shipment shall be removed.

## 5.2 Shipping Requirements:

- 5.2.1 The semipreg product shall be packaged in a suitable double walled cardboard box, or equivalent that has provisions internally to support the rolled core on both ends. Due to weight of the standard product length (250 meters), the box shall be strapped to a typical wooden pallet (skid) for lifting and protection. Corners of the box shall not extend beyond the pallet to prevent damage.
- 5.2.2 The laminate product shall be shipping with a double walled cardboard box (lower box with lid), with specific protection applied to the edges of the laminates to prevent damage. The box may be loaded with varying laminates, but the box shall be "filled" to prevent excessive movement of the laminates. "Fill" material shall consist of air bags. The laminates shall also be interleaved with cardboard to prevent rubbing a contact with adjacent packaged material. The box shall also be strapped to a wooden pallet and the edges shall not protrude over the edge. Once strapped to the pallet the shipment shall be shrink wrapped to limit movement.
- 5.2.3 Normal ground shipment temperature not below -20°F or exceeding 110°F.

## 5.3 Receipt at Purchaser:

- 5.3.1 Semipreg and laminate shall be stored in a manner to prevent exposure to UV light sources in an environment 5-30°C (40-86°F) and less than a 50% relative humidity. Direct exposure to sunlight or rain shall also be avoided to prevent loss in performance.
- 5.3.2 If requested by the supplier and documented on the purchase order, retain the shipping container, spools, and temperature recording instruments for return to the supplier.

## 6. ACKNOWLEDGEMENT:

A vendor shall mention this specification number and the applicable detail specification number and their revision letters, if any, in all quotations and when acknowledging purchase orders.

## 7. REJECTION:

Product not conforming to this specification and the applicable detail specification, or to modifications authorized by purchaser, will be subject to rejection.

## 8. NOTES:

This section of the specifications is reserved for explanatory and other notes.


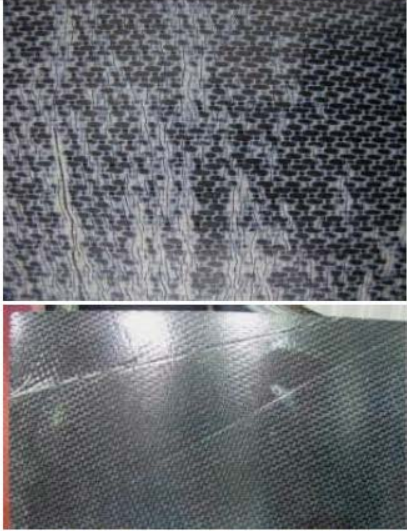

## 8.1 Definitions:

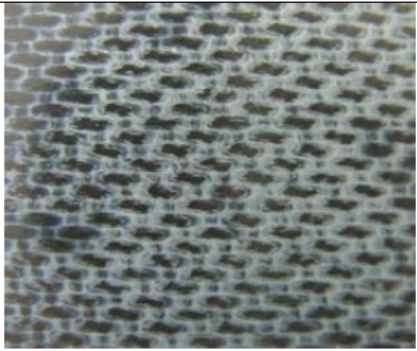


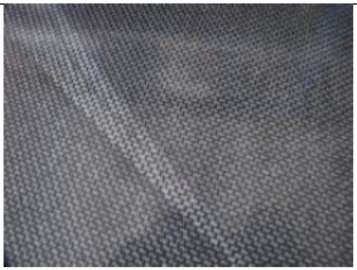

For definitions that are not provided in this specification or other applicable NCAMP specifications, the definitions in DOT/FAA/AR-06/10 and DOT/FAA/AR-07/3 shall apply. For definitions not provided in DOT/FAA/AR-06/10 and DOT/FAA/AR-07/3, the definitions in ASTM D3878 shall apply. For definitions not provided in ASTM D3878, the definitions in CMH-17 (formerly MIL-HDBK-17) shall apply. The document listed may or may not be used in their entirety.

**9. Appendix:**

**9.1 Visual inspection on Consolidated Laminate:-**

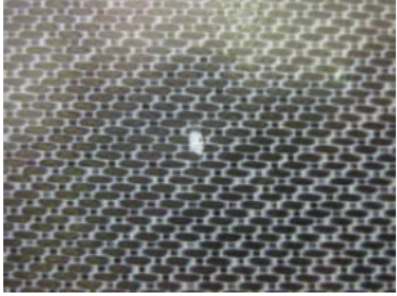




The following depiction are to be considered critical defects and marked accordingly to preclude the use of the laminate, they are suggested criticality level, further examination, NDI and evaluation maybe required.




No.	Defect(s)	Criticality level	Representation
1	Brown stain	Critical	
2	Wrinkles due to polyimide film	Not critical if depth less than 150µm	
3	Surface porosity (pin holes)	Not critical if NDT OK	

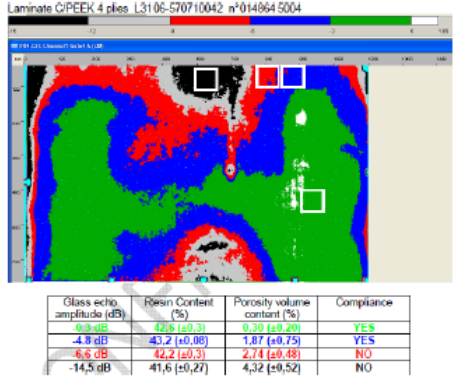
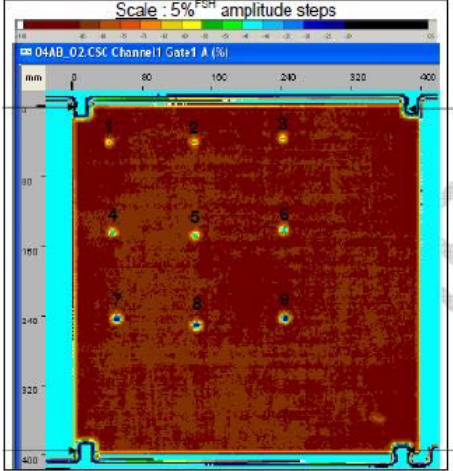
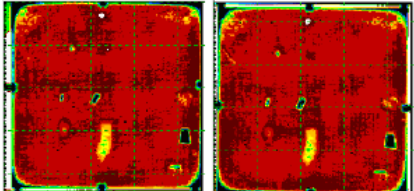
4	<b>White marks</b>	<b>Critical</b>	
5	<b>Wavy white marks</b>	<b>Not critical</b> if <100cm <sup>2</sup>	
6	<b>Tight or loose warp yarn</b>	<b>Not critical</b>	
7	<b>Widened butt-joint **</b>	<b>Critical</b> If overlap or if width > 6 mm in case of lay-up without overlap	
8	<b>Black line</b>	<b>Not critical</b>	

9	<b>Carbon flock</b>	<b>Not critical</b> if < 5 cm <sup>2</sup>	
10	<b>Indentation</b>	<b>Not Critical</b> If diameter < 10mm and depth less than 100 μm	
11	<b>Warp or weft defect</b>	<b>Not critical</b>	
12	<b>Resin rich area</b>	<b>Not critical</b>	
13	<b>Broken yarn</b>	<b>Critical</b>	



14	<b>White spot</b>	<b>Critical</b>	
15	<b>Wavy dark zone</b>	<b>Not Critical</b> If < 100cm <sup>2</sup>	
16	<b>Damaged corner or edge</b>	<b>Critical</b>	
17	<b>White marks on 1G/2G laminates</b>	<b>Not Critical</b>	
18	<b>Black Spot on 1G/2G laminates</b>	<b>Not critical</b>	

19	Yellow area on 1G/2G laminates	Not critical	
20	White point on 1G/2G laminates	Not critical	Not available
21	Yarn inclusion on laminate surface	Not Critical on bare laminate If < 5 cm <sup>2</sup>	Not available
22	Scratches due to handling	Not critical if depth < 150µm	Not available
23	Overlap	Not critical	
50	Thickness out of specification	Critical	

<p>51</p>	<p><b>Porosity (NDT Defect)</b></p>	<p><b>Not critical</b> if diameter &lt; 6 mm or &lt; 6 x 6 mm<sup>2</sup></p>	 <p>Laminate C/PEEK 4 plies L3106-570710042 n°014864 5004</p> <table border="1"> <thead> <tr> <th>Glass echo amplitude (dB)</th> <th>Resin Content (%)</th> <th>Porosity volume content (%)</th> <th>Compliance</th> </tr> </thead> <tbody> <tr> <td>-0,3 dB</td> <td>42,6 (+0,31)</td> <td>0,30 (+0,20)</td> <td>YES</td> </tr> <tr> <td>-4,8 dB</td> <td>43,2 (+0,08)</td> <td>1,87 (+0,75)</td> <td>YES</td> </tr> <tr> <td>-8,8 dB</td> <td>42,2 (+0,31)</td> <td>2,71 (+0,48)</td> <td>NO</td> </tr> <tr> <td>-14,5 dB</td> <td>41,6 (+0,27)</td> <td>4,32 (+0,52)</td> <td>NO</td> </tr> </tbody> </table>	Glass echo amplitude (dB)	Resin Content (%)	Porosity volume content (%)	Compliance	-0,3 dB	42,6 (+0,31)	0,30 (+0,20)	YES	-4,8 dB	43,2 (+0,08)	1,87 (+0,75)	YES	-8,8 dB	42,2 (+0,31)	2,71 (+0,48)	NO	-14,5 dB	41,6 (+0,27)	4,32 (+0,52)	NO
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<p>52</p>	<p><b>Delamination (NDT Defect)</b></p>	<p><b>Not critical</b> if diameter &lt; 6 mm or 6 x 6 mm<sup>2</sup></p>	 <p>Scale : 5%<sup>FSH</sup> amplitude steps</p> <p>04AB_02.CSC Channel1 Gate1 A (%)</p>																				
<p>53</p>	<p><b>Inclusions (NDT Defect)</b></p>	<p><b>Not critical</b> if not visible by NDT scan or if diameter &lt; 6 mm or 6 x 6 mm</p>	 <p>RECTO      VERSO</p>																				

\*\*Butt joint or overlap determination

The butt joint zone out of tolerance is determined and marked on the laminate as indicated in the follow

