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NCAMP Material Specification

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Stratasys Inc. Antero(R) 840CN03™ Resin

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REVISIONS:

Rev	By	Date	Pages Revised or Added
N/C	Royal Lovingfoss	04/24/2024	Document Initial Release
Rev A	Royal Lovingfoss and Jonathan John	1/16/2026	Pg. 4, Merged references from section 18 to section 3. Added Stratasys proprietary document numbers in the list of testing standards. Pg. 6, section 4, updated the Filament material supplier verbiage. Removed all references to DOT/FAA documents. Pg. 7, section 6, underlined material supplier location Pg. 7-9, table 2 and 3, updated footnotes. Added the term “Filament” to the title of section 8.1. Table 4 and 5, updated the footnotes. Pg. 9, section 10, added the test requirements can be found in this material spec document

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1. Scope

This additive specification establishes the requirements for the manufacturing of Fused Deposition Modeling (FDM) filament Antero(R) 840CN03.

2. Classification

2.1 TYPE

The type shall specify the predominant resin used in the feedstock. The resin type shall use ASTM D4000 abbreviations (a.k.a. standard symbols); if the resin type is not listed in ASTM D4000, abbreviations known in the industry shall be used. If the base resin is mixed with an amount of another resin, the name shall include “blend” to indicate a mixture of the blended component. If Type is not specified, Type 1 shall apply.

This is the additive specification of the following material type.

TABLE 1 – Material Types

Type	Base Resin
Type 1	Poly-ether-ketone ketone (PEKK) Blend with 2-3% Carbon Nanotube fill by weight

3. Reference Documents

3.1 Testing Standards

ASTM D257	Standard Test Method for DC Resistance or Conductance of Insulating Materials
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D1238	Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D3171	Standard Test Methods for Constituent Content of Composite Materials
ASTM D4000	Standard Classification System for Specifying Plastic Materials
ASTM D7191	Standard Test Method for Determination of Moisture in Plastics by Relative Humidity Sensor
ASTM E29	Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
ASTM E1356	Standard Test Method for Assignment of the Glass Transition Temperatures by Differential Scanning Calorimetry
SSYS 106194-0000	Filament Pull Force Stratasys proprietary test method
SSYS 106195-0000	Measuring the diameter across the entire length of a canister

3.2 NCAMP Publications

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.

NMS 840	Antero(R) 840CN03Filament Base Specification
NMS 840/1	Antero(R) 840CN03Filament Slash Specification
NPS 88400	NCAMP Process Specification, Fabrication of NMS 840 Qualification, Equivalency, and Acceptance Test Coupons
NRP 101	Prepreg Process Control Document (PCD) Preparation and Maintenance Guide

3.3 US Government Publications

29 CFR 1910.1200	Hazard Communication, Occupational Safety and Health Standards
MIL–D–3464	Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification
MIL-PRF-131	Barrier Materials, Watervaporproof, Greaseproof, Flexible, Heat-Sealable
CMH-17	Composite Materials Handbook (formerly MIL-HDBK-17)

4. Definitions

The following definitions apply to terms that have special meaning as used in this additive material specification:

Raw Resin Lot or Batch	Total quantity of a unique lot or batch identifier as defined by original resin supplier
Filament Lot	The quantity of Stratasys consumables manufactured at one time to a single set of defined properties using a single raw resin lot or batch
Filament Material Supplier	The supplier of Filament
Purchaser	Material user
Recycle Resin	Thermoplastic material that has an additional heat history from the manufacturer after polymerization
Regrind	Material that had been reclaimed by shredding or granulating after Stratasys processing

Virgin Resin	Material that has no other heat history other than polymerization, compounding, and pelletization performed by the resin supplier
Qualification	The process of validation of the Stratasys filament material complying with internal and external standards

For definitions that are not provided in this specification or other applicable NCAMP specifications, the definitions in CMH-17 (formerly MIL-HDBK-17) shall apply.

5. Process Control Document

The manufacturer shall prepare and control a Process Control Document (PCD). The PCD shall be considered proprietary and shall be protected in accordance with disclosure agreements signed by the manufacturer 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. Formal change notification and approval is required before a change may be implemented. NCAMP approval is required for major changes, and is granted through Advance Change notices (ACN).

Changes to the PCD of a qualified material (as defined by DOT/FAA/AR-06/10, DOT/FAA/AR-07/3) are subject to the written approval of NCAMP. Such changes may require substantial testing to demonstrate equivalency.

6. Material Requirements

Raw resin materials shall meet a controlled specification. Recycle resin and regrind shall not be used for any material supplied to this specification.

The extruders qualified to run the Antero(R) 840CN03 are 1.25 inch 24:1 L/D Davis-Standard extruders located at Stratasys, 6855 Shady Oak Rd. Eden Prairie Minnesota 55344

7. Additional Material Manufacturer Qualification

All requests for additional material manufacturer qualification shall be directed to NCAMP or the governing regulatory body.

7.1 Qualification of a Material

Manufacturer will submit a signed test report/Certificate of Conformance that demonstrates the candidate material's ability to meet the specifications in TABLE 2, TABLE 3, TABLE 4 and TABLE 5. The report will include the following information:

1) Manufacturer name and product designation
2) Test Results, including individual specimen values, to prove material meets the requirements of this specification
3) Filament lot number
4) Date of Manufacture
5) Raw Resin lot or batch number

6) A statement that no changes in product formulation, raw materials, basic methods of manufacture, or plant site have occurred since the material was qualified

8. Technical Requirements

8.1 In-Process Filament Canister Requirements

TABLE 2 – In-Process Canister Requirements (Type 1)[1]

Property[2]	Test Method	Number of Replicates
Max Moisture	ASTM D7191	First, middle (roughly) and end per batch[3]
Melt Flow	ASTM D1238	First, middle (roughly) and end per batch[3]

[1] The testing defined in this section is the responsibilities of the manufacturer and need not to be repeated by the material purchaser.
[2] “ind” refers to individual measurements.
[3] Report results for all canisters tested

8.2 Filament Physical Properties

TABLE 3 – Filament Physical Properties (Type 1)

Property	Number of Replicates
Pull Force[1]	One of the first three canisters in the batch (see section 10.1)
Diameter[2][3]	‘Continuously’ (see section 10.2)
Ovality[2][3]	‘Continuously’ (see section 10.2)

[1] Pull force spikes up to 3.75 lbs with SSYS 106194-0000 Stratasys proprietary test method are acceptable provided it meets one of the following criteria:
(a) Length of spike above 1.75 lbs does not exceed 3 feet.
(b) Length of spike above 2.75 lbs does not exceed 1 ft.
This testing is the responsibilities of the filament manufacturer.
[2] Diameter exception due to local flaw is permitted if it is within 0.07390 inch (max) diameter x 0.60 inch length. The diameters of the flaw areas must be included in the diameter average calculation and additionally, it must meet the requirement that 99.73% of diameter readings fall within the given range 0.06790 to 0.07350 inch.
[3] Manufacturer is to measure ‘continuously’ on one spool once it is cooled and packaged. This testing is the responsibility of the filament manufacturer.

8.3 As-printed Specimen Physical Properties

TABLE 4 – As-printed Specimen Physical Properties (Type 1)

Property	Test Method
Thickness[1]	ASTM D3171 or applicable mechanical test method
Surface Resistivity	ASTM D257

[1] Computed from actual qualification printed specimens thicknesses. A minimum of 3 thickness measurements across the specimen width and length from each specimen listed in Table 4 using spherical faced micrometer or equivalent.

8.4 As-printed Specimen Mechanical Properties

TABLE 5 – As-printed Specimen Mechanical Properties

Property	Test Method
Tension Strength and Modulus Room Temperature, Ambient Orientation: XZ	ASTM D638 Type 1
Tension Strength and Modulus Room Temperature, Ambient Orientation: ZX	ASTM D638 Type 1

9. Retention of Qualification Status

No changes in approved product formulation, raw materials, and basic methods of manufacture, or plant site, for a material qualified to this specification and associated slash sheets specifications shall be made without notification to NCAMP via the ACN process.

10. Material Test Methods

All in-process testing requirements must be met as stated in this material specification. Any changes made to the in-process testing requirements must be reported to NCAMP via the ACN process.

All tests are performed in a temperature and humidity controlled environment. Temperature is maintained at 75°F ± 10°F and humidity maintained below 60% RH.

10.1 Pull Force Testing

Pull force testing can be performed once the material has reached room temperature. The pull force test is conducted in accordance with Stratasys proprietary test method SSYS 106194-0000 using a unique test stand equipped with a standard Stratasys FDM system filament drive block and a force transducer and that measures the force required to remove filament from the canister, across the entire length of the canister.

10.2 Diameter Testing

Post process diameter testing is performed if in-line temperature measurement is not used in conjunction with in-line diameter measurement during the production run. Post process diameter testing can be performed once the material has reached room temperature. The diameter test is conducted in accordance with Stratasys proprietary test method SSYS 106195-0000 by measuring the diameter across the entire length of a canister using a laser micrometer similar to what is used in-line.

10.3 Moisture Testing

Moisture testing is performed in compliance to ASTM D7191 prior to shipping.

10.4 Melt Flow Rate

The melt flow rate (MFR) is determined with respect to ASTM D1238 using temperatures and loads defined in TABLE 5. Material will have moisture content meeting limits defined in TABLE 6 prior to testing.

TABLE 6 – Melt Flow Index Testing Parameters

Type	Mass (kg)	Dwell (s)	Cut time (s)	Number of Cuts	Time Reference (s)	Temp. (°C)	MFR (g/10 min)
1	1.2	360	20	3	600	380	0.2 – 2.0

11. Test Failure

If during the testing, a canister of material does not meet the specifications given in TABLE 2, TABLE 3, TABLE 4 and TABLE 5, re-testing will be performed based on failure type. All of the material and physical property requirements must be met prior to material release.

If moisture content fails to meet the requirement then the entire lot of product will be allowed to dry for additional time and moisture will be retested. This is repeated until an acceptable moisture content measurement is achieved, at which time the entire lot of material is released. Material may be vacuum dried if necessary.

For any initial test failure besides moisture content two follow-up canisters will be tested. If either of those two canisters fail to meet the specifications additional canisters will be tested until four consecutive canisters pass. Material that does not meet the specifications will not be used to fulfill Aerospace filament orders.

Defects, as defined by this specification, which are not marked by the manufacturer but found in the material after acceptance shall be cause for rejection and the defective material may be returned to the manufacturer. Defects caused by purchaser mishandling, improper storage, or expiration of storage or out-life are not the responsibility of the manufacturer and shall not be cause for rejection back to the manufacturer.

12. Canister Identification

Each canister and canister box will be labeled with the following information:

1) Part Number
2) Name and Product Designation
3) Filament Lot Number
4) Date of Manufacture
5) Manufacturing Location

13. Traceability

All canisters must be assigned a unique serial number that ties them to a manufactured lot of filament. The manufacturing lot number is tied to the raw resin lot or batch number.

14. Storage and Handling of Filament

Feedstock, after fabrication and testing (if applicable), shall be properly stored in sealed containers within 24 hours of production/use according to the feedstock manufacturer's recommendations with a temperature range of 55°F - 75°F and 60% maximum relative humidity.

15. Storage and Handling of Coupons and Articles

Coupons, after fabrication and testing, shall be properly stored in sealed containers within 24 hours of production/testing according to the feedstock manufacturer's recommendations with a temperature range of 55°F - 75°F and 60% maximum relative humidity.

16. 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 purchaser 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.

17. 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.

18. Environmental, Health, and Safety

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).

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

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

19. Manufacturer's Responsibility

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.

Changes to the filament require review and approval by NCAMP in accordance with 9. Any testing required to validate the changes or adjustment of manufacturing materials, techniques and/or procedures is the manufacturer's responsibility.

20. Classification of Tests and Inspections

20.1 Additional Testing

The purchaser reserves the right to perform additional testing to confirm the manufacturer's certification data, and to approve incoming material for use in the fabrication of production parts. Each canister 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.

20.2 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 of each type of material delivered by the manufacturer.

Before the material is accepted, the purchaser shall perform the following:

20.2.1 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 and meet the requirements of this specification.
d. The Certificate of Conformance is received.

20.2.2 Testing

The purchaser may repeat the manufacturer batch release test per Table 2, Table 3 and Table 4 as part of the receiving inspection tests on each batch of material if they choose.

As use and confidence increase, the receiving inspection testing may be modified based on proven performance in cooperation with the material manufacturer, customer (if purchaser is supplying composite parts to another aircraft company), and appropriate certification agency.

20.2.3 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. 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.

21. Manufacturer Statistical Process Control

The manufacturer 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 7.1. The KC monitoring, typically using control charts, must be provided to material purchasers, certification agencies, and NCAMP staff upon request. The CPP monitoring must also be provided to material purchaser, certification agencies, and NCAMP staff upon request, but proprietary information may be coded or normalized. Alternatively, manufacturer may send the KC data to NCAMP for inclusion in the NCAMP's control charts which are available to the public.

22. Acknowledgement

A manufacturer 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.

23. Rejection

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