



AEROSPACE MATERIAL SPECIFICATION

AMS7100™/1

Issued

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Fused Filament Fabrication Process - Stratasys Fortus 900mc Plus
with Type 1, Class 1, Form 1, Grade 0
Natural Color Material for

RATIONALE

This documents is intended to describe the specific technical and parameter requirements needed for the Stratasys Fortus 900mc Plus with Type 1, Class 1, Form 1, Grade 0, natural color material for fused filament fabrication system to produce parts capable of service in aerospace service. It will define and discuss critical requirements which have a substantial effect on the print quality and final print part properties. No such document currently exists and such a document is needed to maintain high quality additive manufactured material extruded produced components.

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1. SCOPE

This specification establishes the critical controls and requirements for the production of reliable, repeatable, reproducible aerospace parts by the Stratasys Fortus 900mc Plus with Type 1, Class 1, Form 1, Grade 0, natural color material for fused filament fabrication system, but is not limited to such application. This procedure will establish the configuration of the machine and build parameters, the testing methodology, and mechanical specification minimum guidelines required to create aerospace part.

1.1 Detail Specification

The base specification contains generic requirements that apply to every fused filament fabrication system (machine/software/feedstock combination). This slash sheet contains additional or superseding properties and requirements that apply to the Stratasys Fortus 900mc Plus with Type 1, Class 1, Form 1, Grade 0, natural color material fused filament fabrication system. This specification is in addition to and in no way limiting, superseding, or abrogating any contractual obligation as required by the applicable procurement documents. In the event of conflict in requirements, the order of precedence shall be this detail specification (AMS7100/1), the associated base specification (AMS7100), all other specifications referenced in this document.

1.2 Classification

1.2.1 Fused Filament Fabrication System

The fused filament fabrication system is the combination of equipment, software, and feedstock that is configured, calibrated, and maintained as outlined per this detailed specification.

1.2.2 Machine

The fused filament fabrication machine in this detailed specification is Stratasys Fortus 900mc Plus. The serial number is located on the back of the Stratasys Fortus 900mc Plus. The head serial number is the nine-digit number, without the dash (e.g., 123100454) located on the extrusion head. Both numbers shall be recorded for documentation and traceability purposes. The Stratasys's T16A tip (Stratasys P/N 511-10410) shall be used in conjunction with the Stratasys Fortus 900mc Plus for this detailed specification.

1.2.3 Software

There are multiple software programs needed for fused filament fabrication. The software used for this detailed specification shall be Stratasys's Insight Version 11.5 and Stratasys's Controller Software Version 3.21.2922.0.

1.2.4 Feedstock

The feedstock in this detailed specification is Type 1, Class 1, Form 1, Grade 0, natural color material. The feedstock shall be procured, processed, and identified according to AMS7101/1.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS7100 Fused Filament Fabrication, Process Specification for

AMS7101 Fused Filament Fabrication, Material for

AMS7101/1 Material for Fused Filament Fabrication, Type 1, Class 1, Form 1, Grade 0, Natural Color

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM 52921-13 Standard Terminology for Additive Manufacturing-Coordinate Systems and Test Methodologies

ASTM D638 Standard Test Method for Tensile Properties of Plastics

ASTM D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

ASTM D7191 Standard Test Method for Determination of Moisture in Plastics by Relative Humidity Sensor

2.3 Stratasys Publications

Available from Stratasys Publications, 9600 West 76th Street, Suite 108, Eden Prairie, MN 55344, <http://www.stratasys.com>.

SSYS 108314-0010 Fortus 900mc 3D Production System User Guide

2.4 Definitions and Acronyms

Definitions are according to base specification AMS7100.

3. TECHNICAL REQUIREMENTS

3.1 Facility

The fabrication facility conditions, electrical, and compressed air must meet the requirements as specified in Table 1.

Table 1 - Fabrication facility requirements

Utility	Requirement	Allowable Range
Facility Conditions	Location	Indoors only
	Temperature	15.5 to 29 °C (60 to 85 °F)
	Relative humidity	0 to 80% RH
Electrical Requirements ²	Rating	13.5 KVA
	Voltage	230 VAC nominal three-phase service with 5% regulation ¹
	Frequency	50 Hz or 60 Hz
	Current	40 A circuit
	Full load current	34 A full load current on all three phases
	Maximum inrush current	570 A for 2 ms
Compressed Air ³	Supply pressure	90 to 120 psi
	Input manifold pressure setting	75 psi ± 5 psi
	Quality	Non-lubricated, non-condensing
	Connection	A-A-59439 dimensional standard

Notes:

¹ 230 VAC as measured phase-to-phase.

² Operation of the FFF system outside of this range is not recommended and degradation of the FFF system performance and shortened component life expectancy will be experienced. The FFF system shall be operated on a three-phase service meeting the recommendations for power quality give in IEEE Standard 141-1976.

³ Requirements of air-line with compressed air that is supplied to the FFF system.

3.2 Materials

3.2.1 Direct Material

The Type 1, Class 1, Form 1, Grade 0, natural color material shall be procured and processed to AMS7101/1. The feedstock supplier shall provide the appropriate documentation and testing as specified in AMS7101. Each part shall have the feedstock lot identified and documented for traceability by the user's internal documentation system.

3.2.2 Indirect Materials

Consumable and expendable materials are necessary for part production but not a part of the final product assembly. These materials shall not adversely affect or contaminate the finished product. Indirect materials shall be as specified in Table 2.

Table 2 - Consumables for printing Type 1, Class 1, Form 1, Grade 0, natural color material

Material	Description	Specification or Approved Part Number(s)
Support Feedstock	Ultem support	Stratasys P/N 355-03220
Model Tip	T16A	Stratasys P/N 511-10410
Support Tip	T16	Stratasys P/N 511-10401
Build Sheets	Polyethersulfone (PES) build sheets	Stratasys P/N 325-00400, P/N 325-00475, P/N 325-00475-S, P/N 325-00200, P/N 325-00275, or P/N 325-00275-S purchased after July 2015; no reuse permitted

3.2.3 Storage and Pre-Processing

Feedstock storage area conditions shall maintain a temperature between 13 to 24 °C (55 to 75 °F) and a relative humidity of 0 to 60%. If conditions exceed requirements, feedstock shall be tested for moisture content per 3.2.3.1. Type 1, Class 1, Form 1, Grade 0, natural color material shall be stored unopened in the original canisters until ready for installation and use in the FFF system within the 36 months from date of manufacture shelf life.

Opened, partially used canisters shall be sealed by retracting all filament feedstock and returning the stopper to prevent moisture absorption and can be stored with unopened canisters. Opened, partially used canisters can be stored for 36 months from date of manufacture after opening provided the factory seals and caps are returned to place after use. Opened, partially used canisters that have been stored for longer than 12 hours shall be tested for moisture content per 3.2.3.1.

3.2.3.1 Feedstock Moisture Dryness and Testing

Feedstock material shall have a moisture content less than 0.01% by mass as tested per ASTM D7191 or another standard if shown to be equivalent. If feedstock moisture content does not meet this criterion the feedstock will be dried per procedures in 3.2.3.2 and retested. If canister fails a second time, feedstock shall be rejected and disposition by a user approved authority.

3.2.3.2 Feedstock Drying Procedures

The feedstock shall be dried by removing the plastic plug on the top of the canister and placed in upright position in a vacuum oven at 68 °C ± 5 °C (154 °F ± 9 °F). Drying oven temperature must not exceed 75 °C (167 °F). Feedstock must be dried in oven for a minimum of 12 hours. All drying conditions must be recorded through user's internal documentation system.

3.3 Equipment

The Stratasys Fortus 900mc Plus shall be identified by names or serial numbers for setup and traceability. Serial numbers shall be recorded. A record of all machine maintenance activities, calibrations, and repairs shall be maintained for each system and stored through the user's internal documentation system. The location of each machine shall also be identified.

All systems shall be calibrated in accordance with Stratasys's SSYS 108314-0010 calibration procedure at a minimum.