



SAF™ PA12 Powered by Evonik®

Our lowest cost
PA12 yet





Overview

Processed with SAF™ technology on the Stratasys H350™ 3D printer, Stratasys SAF PA12 – Powered by Evonik® delivers production-grade plastic parts for high-volume demands – driving new areas of business growth. This material enables a high nesting density while maintaining high part consistency to deliver production-level yields.

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Ordering information

Printer	Layer height	Build volume (XYZ)	Scraper tip
H350™	0.1mm (0.03inch)	315 x 208 x 293 mm (12.4 x 8.1 x 11.5 inch)	Included

Table 1: Printer information

Part number	Description	System compatibility
X3D-01011	HAF™ - High Absorption Fluid Cartridge 4l	H350™
X3D-01374	SAF™ PA12 - Powered by Evonik® Infinam PA 6001 P, pack of 2x10Kg (20Kg)	H350™

Table 2: Material ordering information

Contact your Stratasys representative for ordering information

Workflow

The table below summarizes the entire printing process of SAF H350:

Step	Process	Details
1	Printing	Parts were built using standard machine settings following the H350 installation process. The bed temperature was established using a standard build prior to production. The material consisted of 70% used powder and 30% virgin powder by mass, in accordance with PA12 H350 guidelines.
2	Cooling	Following removal from the machine, the parts were allowed to cool for 24 hours
3	Cleaning/ Depowdering	After cooling, parts were manually broken out, followed by powder removal using bead blasting with a DyeMansion Powershot C. Media: Glass beads (180–300 µm). Pressure: 2.5 bar



Mechanical Properties

The mechanical data in this datasheet were generated from parts in the “Full Standard Test Build” (Figure 1) built using PA12 – Powered by Evonik®, processed using SAF™ technology on the Stratasys H350. The “Full Standard Test Build” is robust in that it tests both mechanical and geometric performance from within the same build. However, the build itself has been modified to focus on specific customer PA12 requests (more accuracy, less mechanical data compared to the High Yield PA11 FSTB).

Comprehensive Sample Sizes

The mechanical data comes from over 500 tensile specimens (>290 in X/Y and >250 in Z), 225 flexural specimens (150 in X/Y and 75 in Z) and 225 impact specimens (150 in X/Y and 75 in Z), all printed in 15 builds from 3 different printers. Each build has 18 tensile specimens in the ZX orientation and 20 collectively in the X and Y orientations.

Tensile specimens	Flexural specimens	Impact specimens	Heat Deflection Temperature (HDT) specimens
The dimensions of the specimens were $165 \times 13 \times 3.2$ mm ($6.500 \times 0.500 \times 0.125$ in.) in all three build orientations. The specimens were tested in accordance with ASTM D638-14 (Type I), including specimen conditioning and tensile loading to failure to determine the tensile properties of the material.	The dimensions of the specimens were $127 \times 12.5 \times 3.2$ mm ($5.000 \times 0.500 \times 0.125$ in.) in all three build orientations. The specimens were tested in accordance with ASTM D790-17, including specimen conditioning and three-point bend testing to evaluate flexural strength and flexural modulus.	The dimensions of the specimens were $63.5 \times 12.7 \times 3.2$ mm ($2.500 \times 0.500 \times 0.125$ in.) in all three build orientations. The specimens were tested in accordance with ASTM D256-10, including specimen conditioning and notched Izod impact testing to determine the impact resistance of the material.	The dimensions of the specimens were $127 \times 12.7 \times 3.2$ mm ($5.000 \times 0.500 \times 0.125$ in.) in all three build orientations. The specimens were tested in accordance with ASTM D648, including specimen conditioning and heat deflection temperature testing under the specified load conditions to determine the thermal performance of the material.

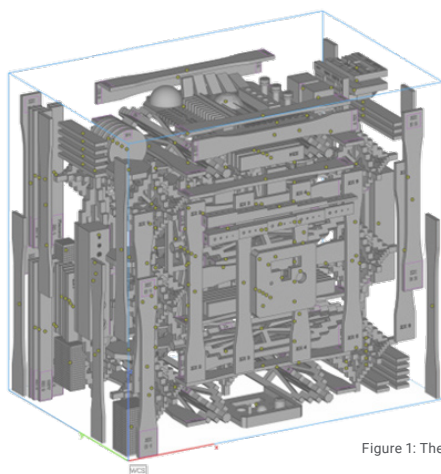


Figure 1: The Full Standard Test Build designed for PA12



Standard Build and Test Practices

The build was prepared using GrabCAD Print Pro. All testing was based on ASTM or ISO standards where applicable. All parts were preconditioned according to ASTM D618-13.

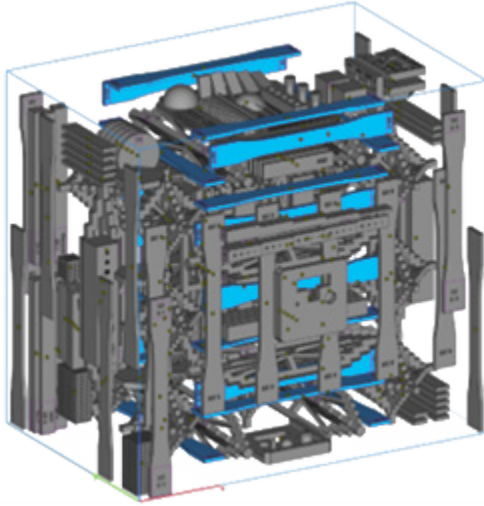


Figure 2: The placement of the X/Y tensile specimens shown for the full build (above) and tensile only (below)

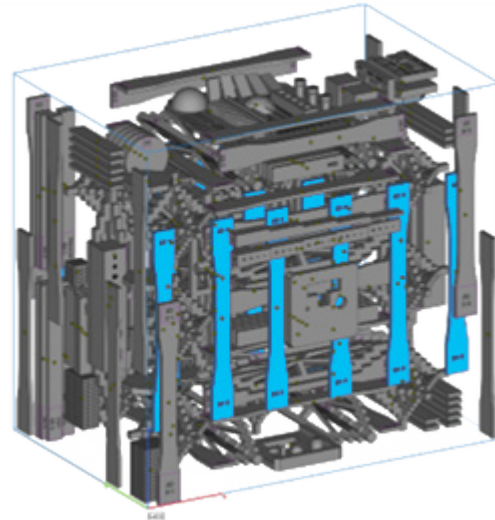
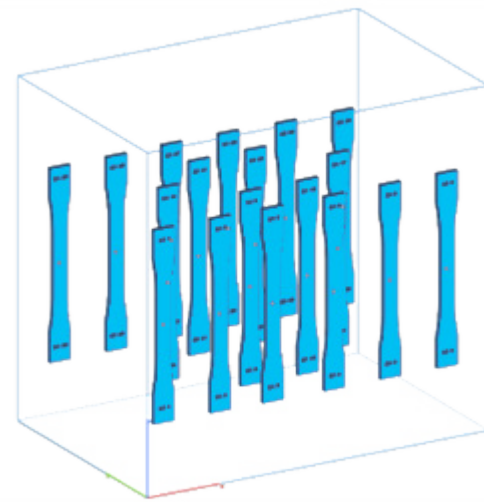
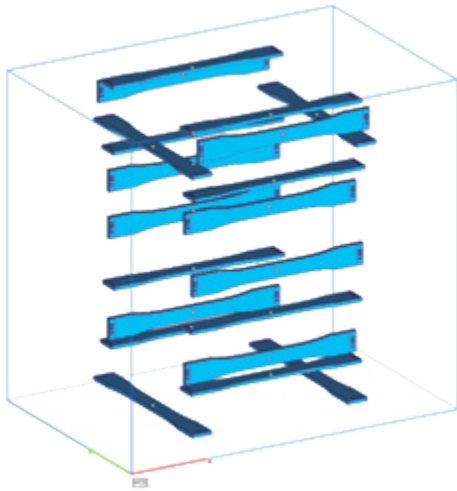


Figure 3: The placement of the ZX tensile specimens shown for the full build (above) and tensile only (below)





Full Build Characterization

The “Full Standard Test Build” contains a wide spread of ASTM D638-14 Type 1 tensile specimens in three orientations: ZX (upright), XZ (on end) and XY/YX (laid flat). The specimens are pulled at 50mm/min cross head speed according to the ASTM D368 standard.

The 20 XY, XZ and YX specimens (highlighted in Figure 2) and the 18 ZX specimens (highlighted in Figure 3) are comprehensively placed within the test build, allowing full characterization of the build volume and real confidence in the mechanical performance of the H350.

The test build also contains geometric property specimens, physical property specimens and give-away parts at a part nesting density of 12%.

Property	Unit	XZ, YX ¹	ZX ¹
Tensile properties: ASTM D638-14			
Tensile Strength	MPa	47 (2.3)	45 (2.2)
	psi	6817 (754)	6672 (319)
Elongation at Break	%	11 (2.2)	6 (1.7)
0.2% Offset Yield Strength	MPa	33.5	32.2
	psi	4589	4670
Tensile Modulus	MPa	1750 (100)	1700 (100)
	psi	254 (14)	247 (14)
Flexural properties: ASTM D790-17			
Flexural Strength	MPa	40 (2)	41 (1)
	psi	5801 (271)	5946 (169)
Flexural Modulus	MPa	900 (60)	925 (29.7)
	psi	131 (8.7)	134 (4.3)
Impact properties: ASTM D256-10			
Notched Impact Strength	kJ/m2	4.17	3.36
	Ft.lbf/in2	1.98	1.6

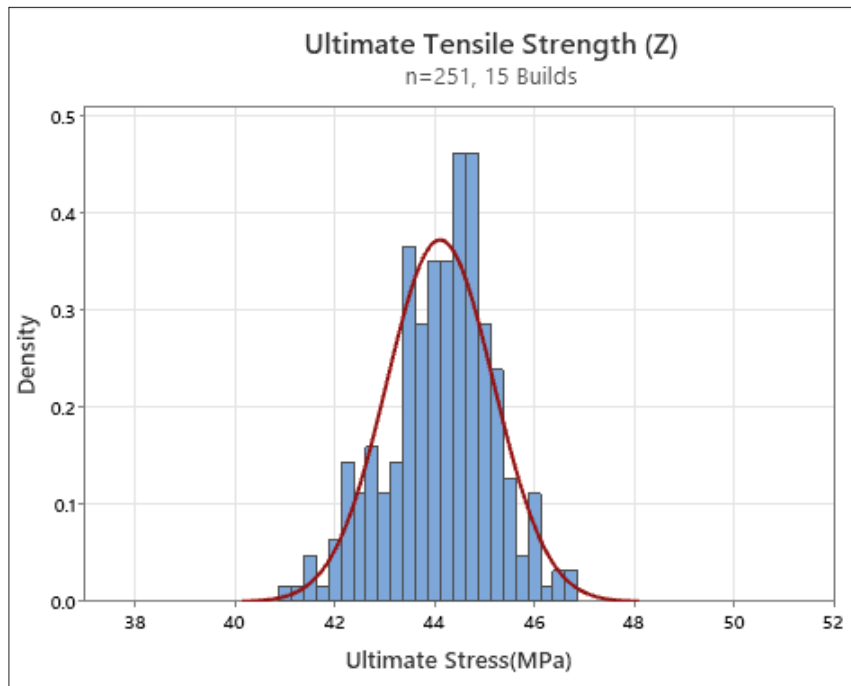
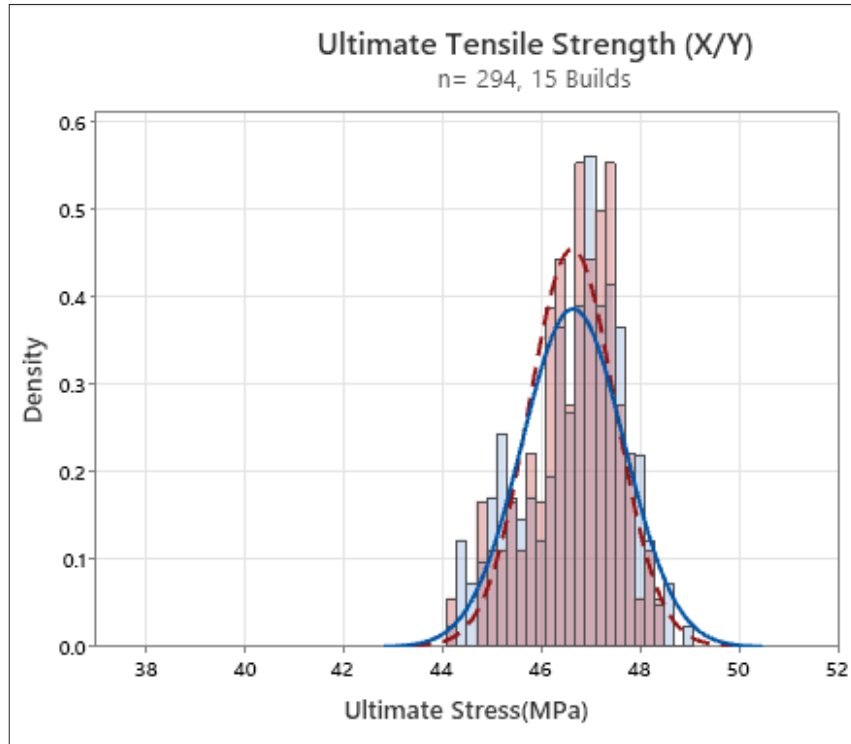
¹Values in parenthesis are standard deviations





The below histograms visualize the mechanical data presented in this datasheet:

Ultimate Tensile Strength (UTS)





Geometric Properties

The following geometric data were generated from the same builds as the previous mechanical data, made possible by the H350's ability to make both strong and accurate parts with the same settings. All parts were built and post-processed using the same standard methods as stated in the mechanical section. Over 3600 dimensions were measured with the Aberlink EXTOL 370 CMM. The geometric data comes from a geometric “star” (nominal range from 5 to 80mm). The placement of these star parts can be seen in Figure 4.

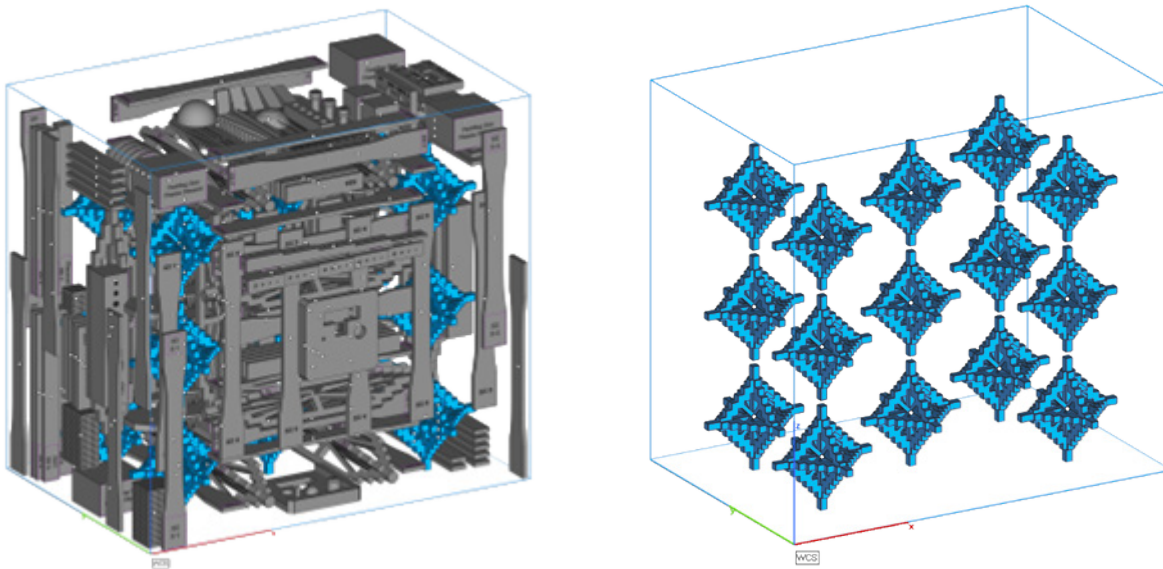
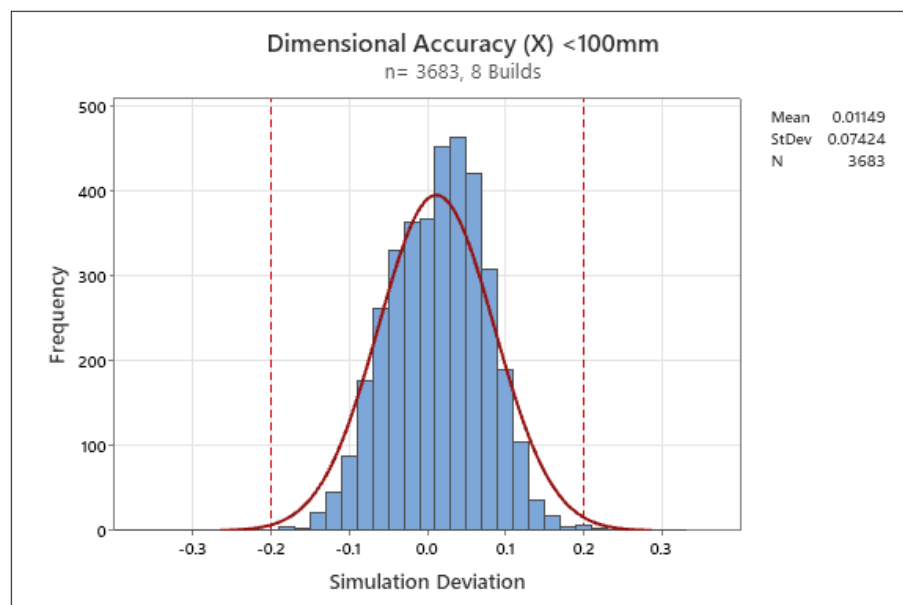
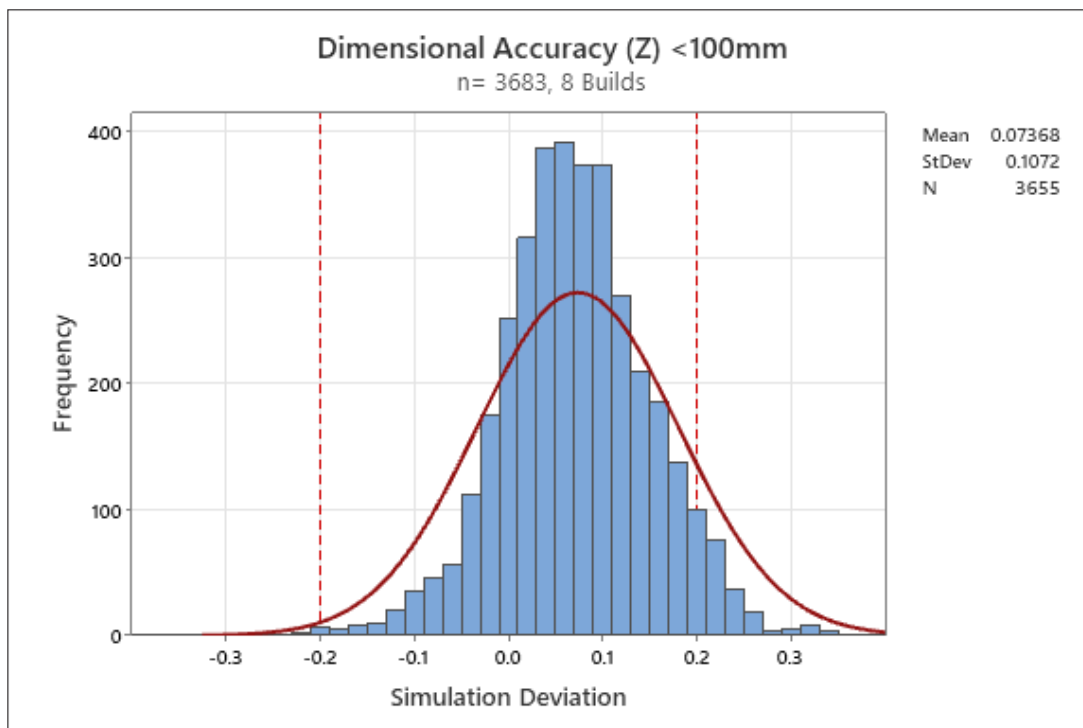
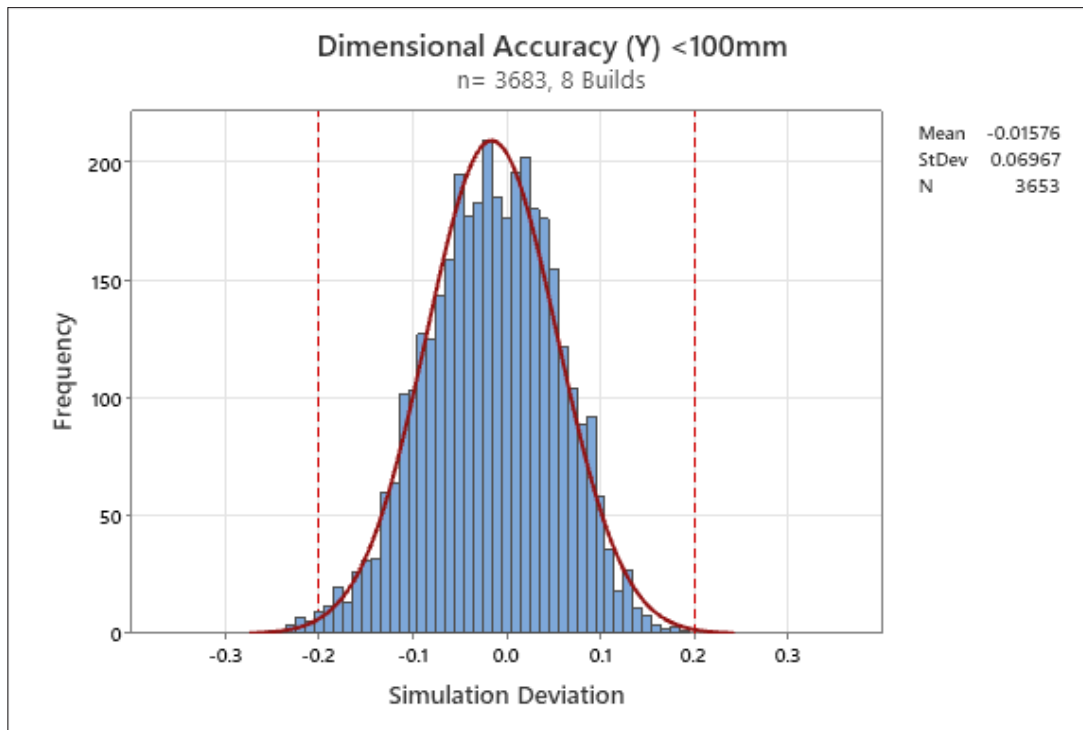


Figure 4: The placement of the geometric specimens within the full test build (left) and placement of the 15 geometric specimens only (right)

The below histograms visualize the geometric data presented in this datasheet – split into X, Y and Z measurements.



**Tolerance****Yield (XY)****Yield (Z)** $\pm 200\mu\text{m}$ (8 thou)

96.6%

95.8%



Physical Properties

General	Value	Unit	Standard
Part Specific Gravity	0.98	-	ASTM D792-13
Virgin Particle Size D50	56 (2.2)	µm (thou)	-
Virgin Powder Melting Point	185 (365)	°C (°F)	-
Thermal	Mean	Unit	Standard
Heat Deflection Temperature (0.45MPa/65psi)	173 (343)	°C (°F)	ASTM D648
Heat Deflection Temperature (1.82MPa/264psi)	77 (171)	°C (°F)	ASTM D648
Coefficient of Thermal Expansion	160 (0.089)	µm/°C.m (thou/in.°F)	ASTM E831
Specific Heat Capacity (20°C/68°F)	1.69 (0.4)	J/g.°C (BTU/lbm.°F)	ASTM E1952
Thermal Conductivity (23°C/68°F)	0.192 (1.34)	W/°C.m (BTU/hr.ft.°F)	ASTM E1952
Electrical	Mean	Unit	Standard
Surface resistivity	5.53 x10 ¹³	Ohm	ASTM D257
Volume resistivity	4.19 x10 ¹⁴	Ohm-cm	ASTM D257
Flammability	Mean	Unit	Standard
UL94 HB	Pass*	Not Applicable	UL94 (2013)
Reusability	Value	Unit	Standard
Typical Powder Mix Ratio (Virgin)	30	%	-

* Product is not currently UL Blue Card Registered.

Disclaimer:

¹ Customer acknowledges the contents of this document and that Stratasys parts, materials, and supplier are subject to its standard terms and conditions, available on <http://www.stratasys.com/legal/terms-and-conditions-of-sale>, which are incorporated herein by reference.

² The specifications and/or information on which this document is based are subject to change without notice.

³ The information presented are typical values intended for reference and comparison purposes only. They should not be used for design specifications or quality control purposes.

End-use material performance can be impacted (+/-) by, but not limited to, part design, end-use conditions, test conditions, etc. Actual values will vary with build conditions. Tested parts were built on the Stratasys H350 3D printer. Product specifications are subject to change without notice. The performance characteristics of these materials may vary according to application, operating conditions, or end use. Each user is responsible for determining that the Stratasys material is safe, lawful, and technically suitable for the intended application, as well as for identifying the proper disposal (or recycling) method consistent with applicable environmental laws and regulations. Stratasys makes no warranties of any kind, express or implied, including, but not limited to, the warranties of merchantability, fitness for a particular use, or warranty against patent infringement.



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Certification
ISO 9001:2015



MATERIAL DATA SHEET
SAF

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