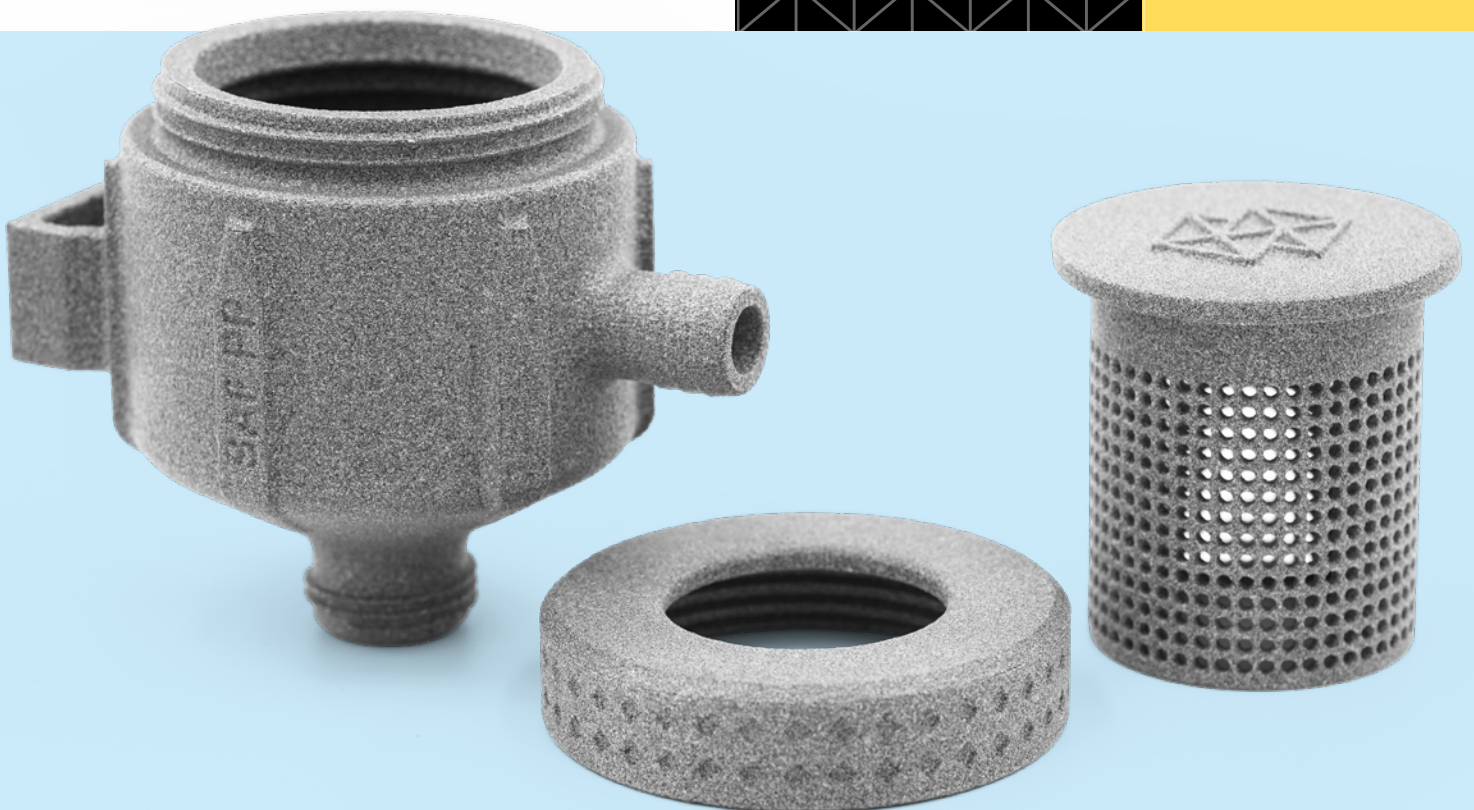


Stratasys SAF™ PP (Polypropylene)

Extended Material Datasheet



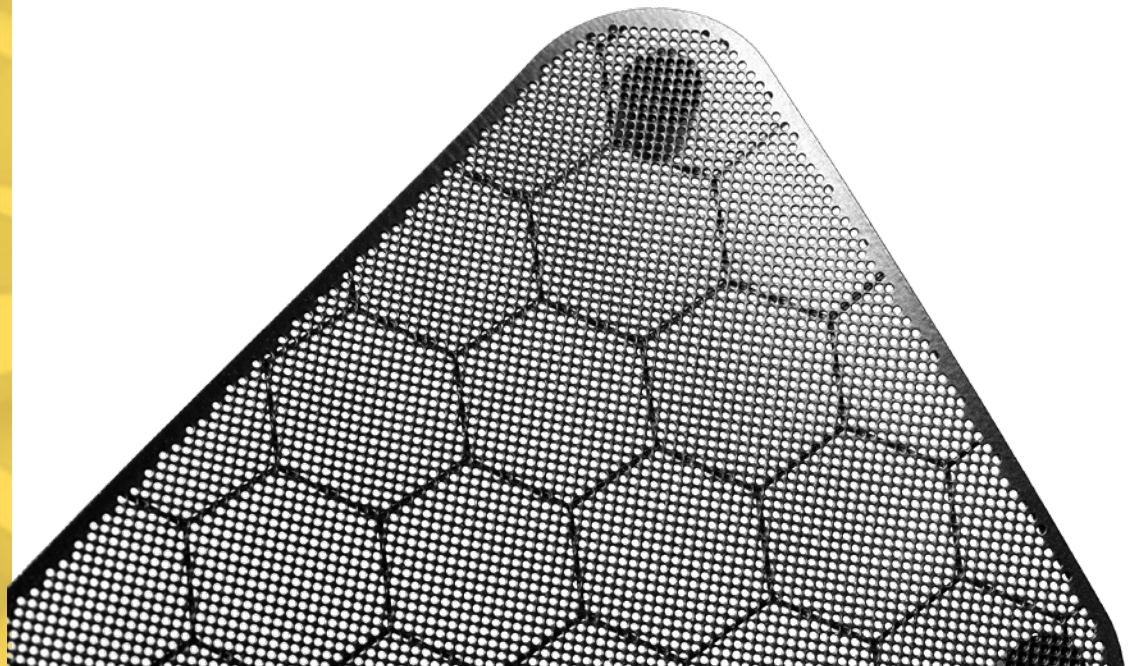


Overview

Processed with SAF™ technology on the Stratasys H350™ 3D printer, SAF PP delivers production-grade polypropylene parts for high-volume demands—driving new areas of business growth. Stratasys SAF PP enables a high nesting density while maintaining exceptional surface finish and dimensional accuracy, ensuring consistent, high-quality production-level yields. With its superior chemical resistance, weldability, light weight, and watertight properties, SAF PP is ideal for a wide range of applications across diverse industries.

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PP H350 Validation Build Plan

Comprehensive Sample Sizes

The mechanical data comes from over 2,000 tensile specimens (~950 in Y/X and 1,100 in Z) all printed in >80 builds from 5 different printers split between 2 locations. Three different supplier batches of PP powder were also used for the validation. This is shown in graphical representation in Figure 1.

In addition to the mechanical tensile test pieces, over 390 flexural specimens (260 in X/Y and 130 in Z) and 375 impact specimens (250 in X/Y and 125 in Z), printed across 42 builds across the 5 printers and 2 locations were also tested.

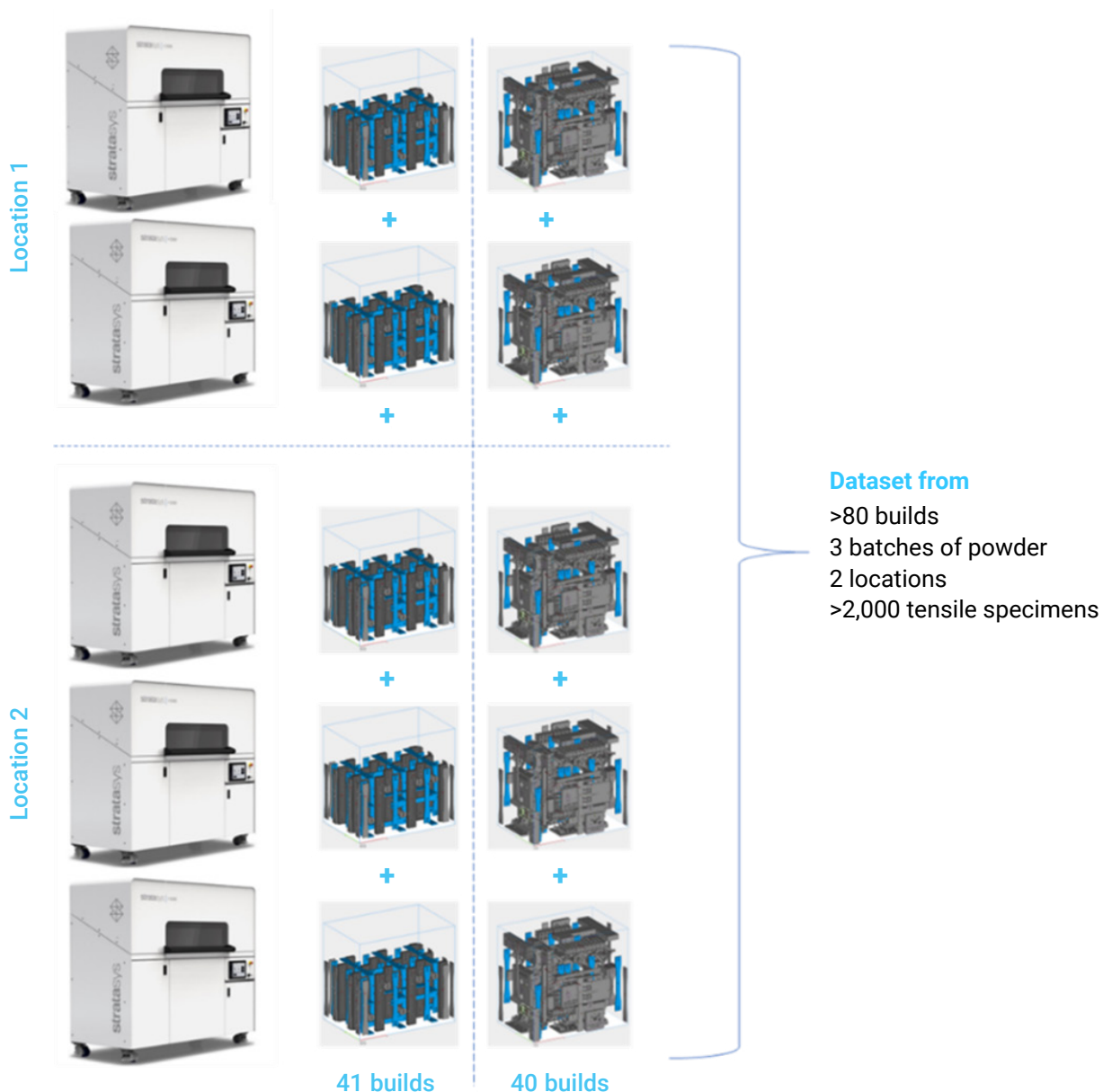


Figure 1: Graphic representation of the number of machines and test builds used to generate mechanical property dataset for the PP extended datasheet



Mechanical Properties

The tensile properties in this datasheet were generated from ASTM tensile bars from two builds: the Tensile Test Capability build (TTC) and the Full Standard Build (FSB). The builds are shown in full in Figure 2 with the tensile specimens isolated in Figure 3.

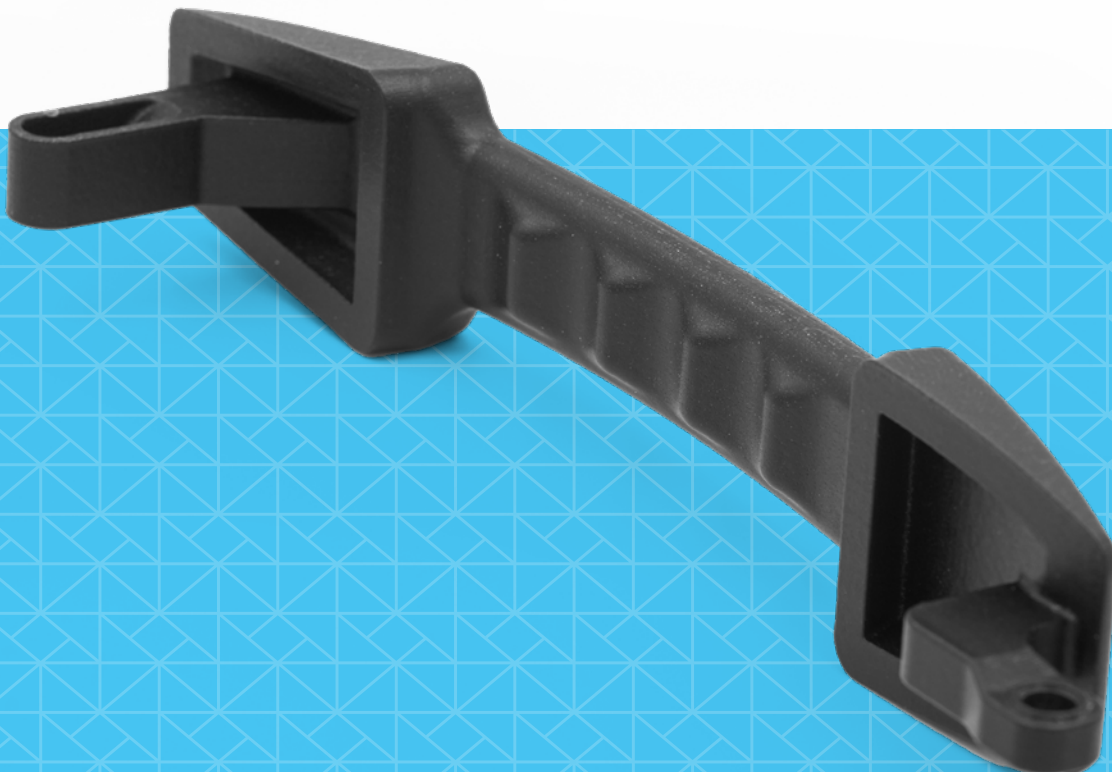
Both the TTC and FSB were built over 40 times during validation on the Stratasys H350 across 5 different machines and 2 locations. Both PP test builds have been uniquely designed to test the mechanical performance from differing builds containing different part geometries to showcase consistent, repeatable and predictable part properties build-to-build.

The TTC contains a spread of ASTM D638-14 Type 1 tensile specimens in four orientations: ZX (upright) XZ (on end), and XY and YX (laid flat).

Additional parts are nested around the 34 tensile specimens, creating a nesting density of 7%. The build also contains a further 15 ZX specimens in cages. These were prepared as a backup to test in case the part properties for certain parts dropped below the lower control limit.¹

The FSB contains ASTM D638-14 Type 1 tensile specimens in two orientations: ZX (upright) and YX (laid flat). The 16 specimens (shown in Figure 2B and 3B) are placed within the test build surrounded by other parts achieving a nesting density of 12%.

¹ Caged parts were not tested during PP validation as the average Z tensile properties did not fall below the LCL for any builds.





Other Mechanical Properties

The FSB also contains Flexural, Impact and physical property specimens as well as give-away parts to demonstrate that both mechanical properties and part aesthetics can be achieved in the same build.

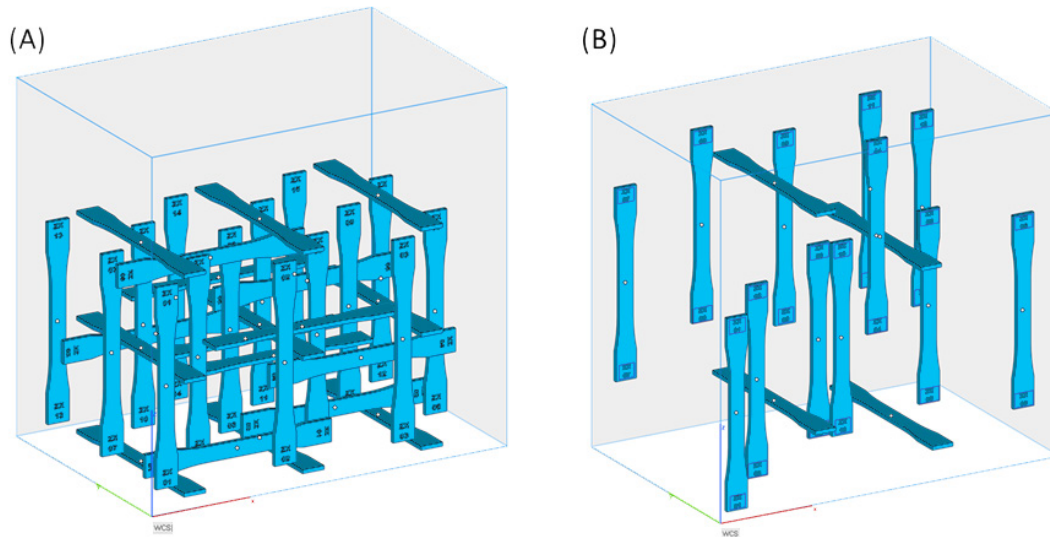


Figure 2: The FSB (A) and TTC (B) test builds used to generate the mechanical data during PP validation.

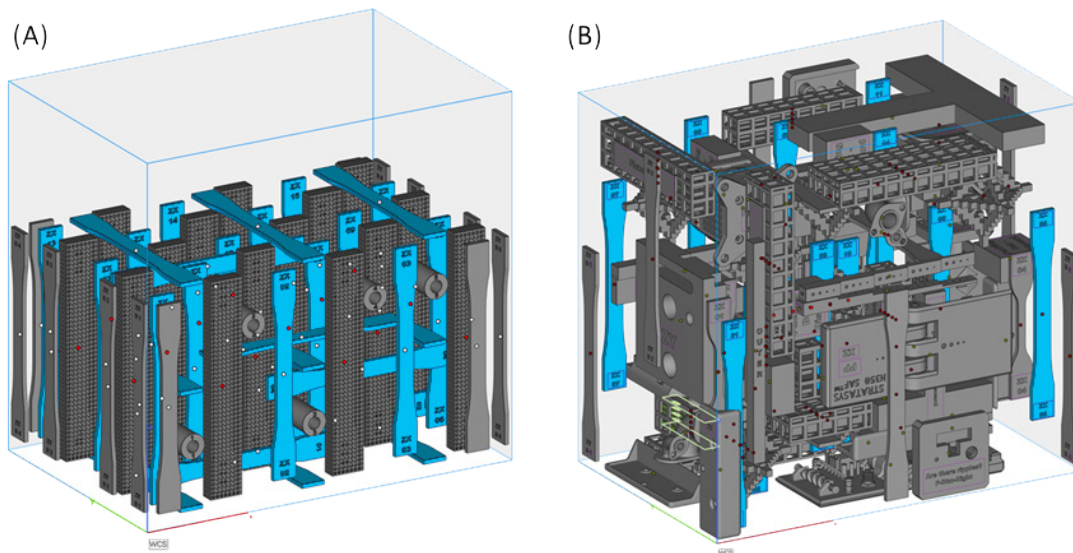


Figure 3: The placement of the XZ, ZX and YX tensile specimens ONLY from the TTC (A), and the FSB (B).

Standard Build and Test Practices

The builds were prepared using GrabCAD Print Pro. The parts were built with standard machine settings following the H350 installation process. The material consisted of 70% used powder and 30% virgin powder by mass, as per H350 guidelines. A total of 3 different batches of PP were tested during the PP validation, all of which were used in the data below.

Post processing of parts was performed in accordance with H350 guidelines. Builds were cooled for 24 hours after completion. Parts were broken out by hand, finishing with automated bead blasting for complete powder removal. All testing was to ASTM or ISO standards where applicable.



Property	Mean	Standard Deviation	Unit	Standard
Tensile Strength (X,Y)	26.5 (3840)	0.7 (106)	MPa (psi)	ASTM D638-14
Tensile Strength (Z)	26.1 (3785)	1.1 (160)	MPa (psi)	ASTM D638-14
Elongation at Break (X,Y)	24	4.4	%	ASTM D638-14
Elongation at Break (Z)	11	2.1	%	ASTM D638-14
0.2% Offset Yield Strength (X,Y)	12.5 (1810)		MPa (psi)	ASTM D638-14
0.2% Offset Yield Strength (Z)	12.7 (1840)		MPa (psi)	ASTM D638-14
Tensile Modulus (X,Y)	1250 (182)	130 (19)	MPa (ksi)	ASTM D638-14
Tensile Modulus (Z)	1260 (183)	145 (21)	MPa (ksi)	ASTM D638-14
Flexural Strength (X,Y)	26.5 (3810)		MPa (psi)	ASTM D790-17
Flexural Strength (Z)	30 (4290)		MPa (psi)	ASTM D790-17
Flexural Modulus (X,Y)	832 (120)	121 (18)	MPa (ksi)	ASTM D790-17
Flexural Modulus (Z)	923 (133)	62 (9)	MPa (ksi)	ASTM D790-17
Notched Impact Strength (X,Y)	3.6 (1.7)		kJ/m2 (Ft.lbf/in2)	ASTM D256-10
Notched Impact Strength (Z)	2.7 (1.3)		kJ/m2 (Ft.lbf/in2)	ASTM D256-10
Poisson's ratio (X,Y)	0.44		-	ASTM D638-22
Poisson's ratio (Z)	0.41		-	ASTM D638-22

The below histograms visualize the PP UTS (Figure 4), EaB (Figure 5) and Modulus (Figure 6) data presented in this datasheet for both X/Y and Z orientations.

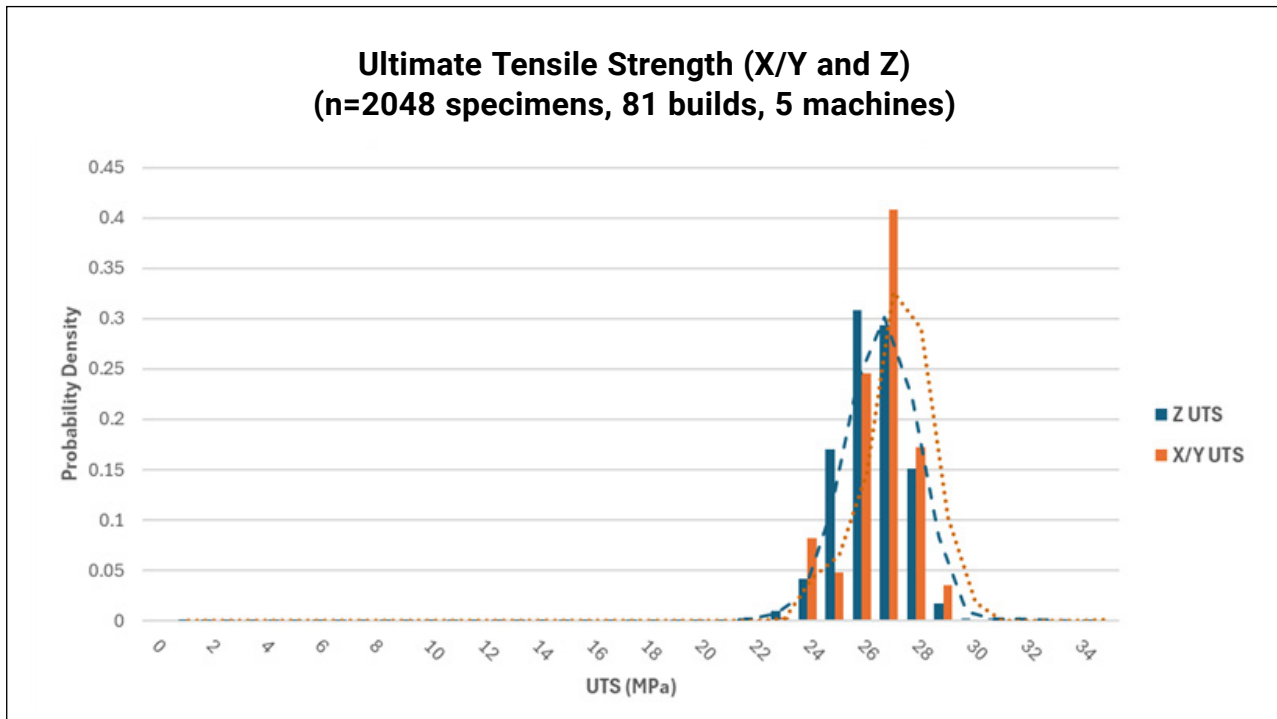


Figure 4: Histogram showing the probability density for Z and X/Y UTS from over 2000 tensile specimens tested during PP validation on the H350.

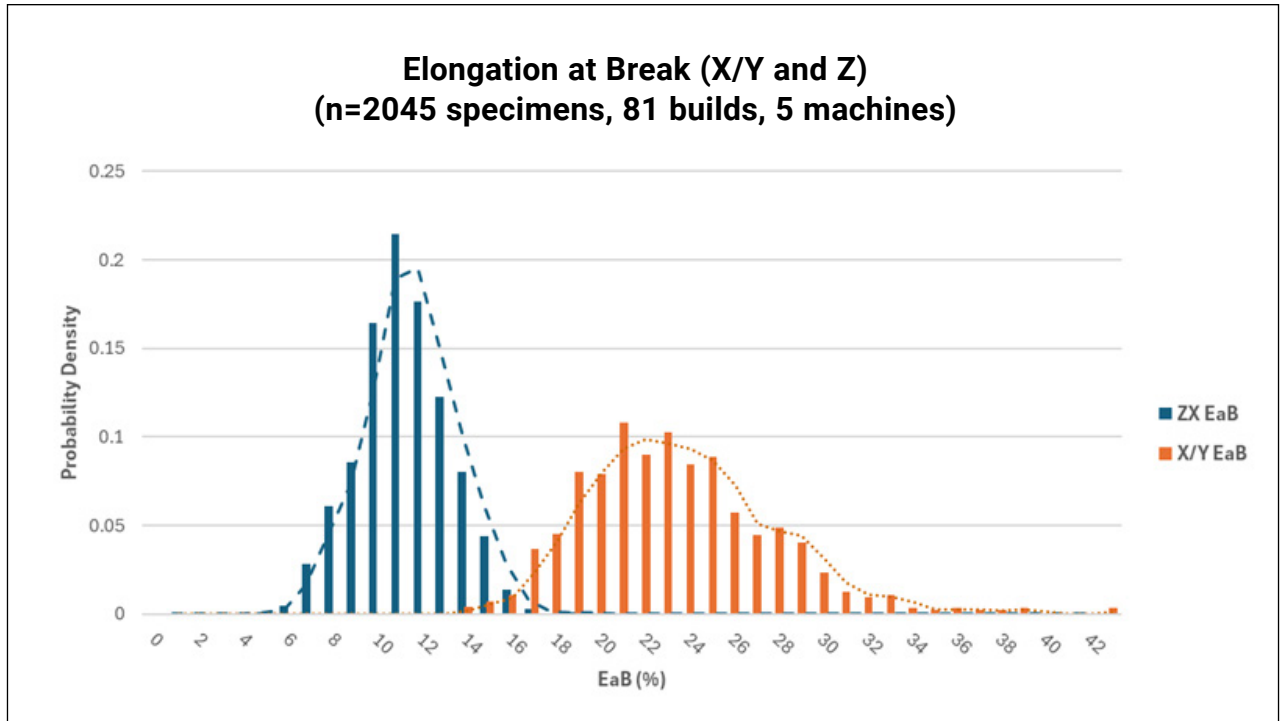


Figure 5: Histogram showing the probability density for Z (blue) and X/Y (orange) EaB from over 2000 tensile specimens tested during PP validation on the H350.

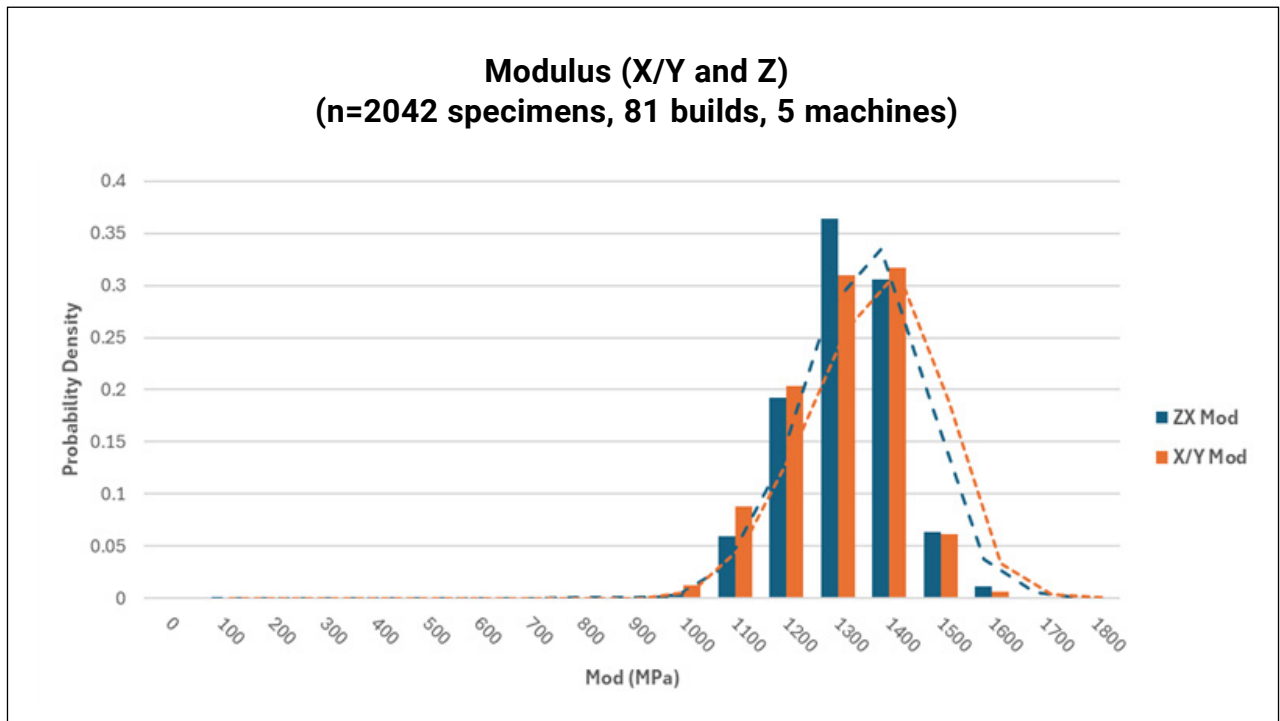


Figure 6: Histogram showing the probability density for Z (blue) and X/Y (orange) Modulus from over 2000 tensile specimens tested during PP validation on the H350.



Validation Tracking of Z UTS

During the PP validation, ZX UTS is tracked build-to-build as a means to monitor layer-to-layer fusion of parts. A lower control limit (of 23MPa) was determined during the verification which acted as a point of reference when testing multiple machines and batches of powder.

Below in Figure 7 the ZX UTS from the 81 validation builds is shown as a function of Build Run ID. The SD for each corresponding build from the samples tested from each build (15 tensile specimens for a TTC, 12 for a FSB) is shown on the same graph.

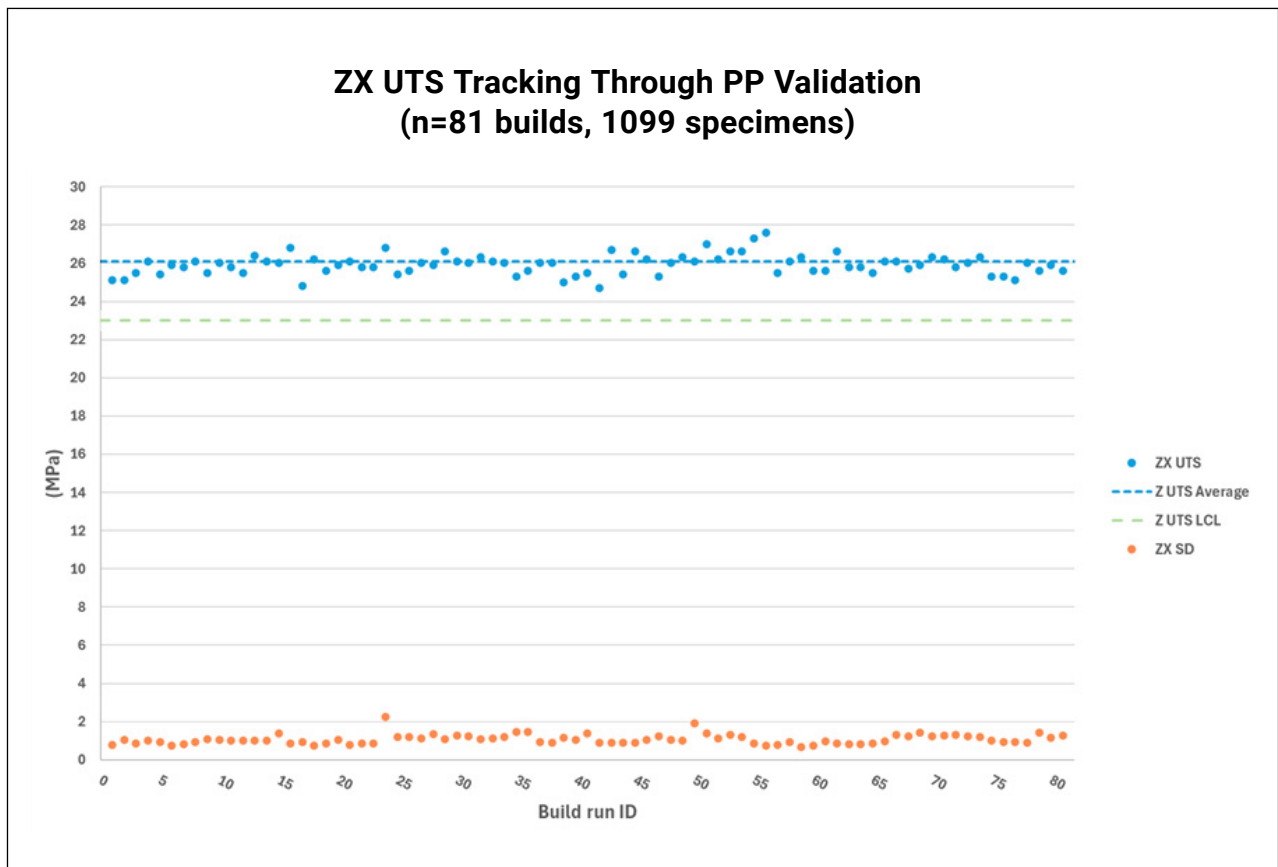


Figure7: Polypropylene Z UTS and SD vs build run ID for the validation builds used in this datasheet.



Physical Properties

General	Value	Unit	Standard
Part Specific Gravity	0.89	-	ASTM D792-13
Virgin Particle Size D50	60-70 (2.4-2.8)	µm (thou)	-
Virgin Powder Melting Point	140 (284)	°C (°F)	-
Thermal	Value	Unit	Standard
Heat Deflection Temperature (0.45MPa/65psi)	107 (225)	°C (°F)	ASTM D648
Heat Deflection Temperature (1.82MPa/264psi)	56 (132)	°C (°F)	ASTM D648
Coefficient of Thermal Expansion	169 (94)	µm/°C.m (thou/in.°F)	ASTM E831
Specific Heat Capacity (20°C/68°F)	1.76 (0.4)	J/g.°C (BTU/lbm.°F)	ASTM E1952
Thermal Conductivity (23°C/68°F)	0.196 (1.36)	W/°C.m (BTU/hr.ft.°F)	ASTM E1952
Electrical	Mean	Unit	Standard
Surface resistivity	5.24 x10 ¹⁵	Ohm	ASTM D257
Volume resistivity	7.39 x10 ¹⁵	Ohm-cm	ASTM D257
Bio compatibility	Result	Unit	Standard
Determination of Skin Irritation	Non-irritant	N/A	ISO 10993-10 2014-10 / OECD 439 2015-07
Determination of Cytotoxicity	Material shows no cytotoxic effect	N/A	DIN EN ISO 10993-5, 2009, Annex D
Flammability	Mean	Unit	Standard
UL94 HB	Pass*	N/A	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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