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HP 3D High Reusability PA 11

Materials Technical Fact Sheet

General Properties

Common information for all print modes

Category	Measurement	Value	Method
General Properties	Powder melting point (DSC)	202°C/396°F	ASTM D3418
	Particle size	54 µm	ASTM D3451
	Bulk density of powder	0.48 g/cm ³	ASTM D1895
		0.017 lb/in ³	
Density of parts	1.05 g/cm ³	ASTM D792	
	0.038 lb/in ³		
Reusability	Refresh ratio for stable performance	30%	
Recommended environmental conditions	Recommended relative humidity	50-70% RH	

Balanced print mode

Technical specifications¹

Category	Measurement	Specimen	Value	Method
Mechanical properties	Tensile strength, max load, ² XY, XZ, YX, YZ	Type V	52 MPa/7542 psi	ASTM D638
		Type I	52 MPa/7542 psi	ASTM D638
	Tensile strength, max load, ² ZX, ZY	Type V	52 MPa/7542 psi	ASTM D638
		Type I	52 MPa/7542 psi	ASTM D638
	Tensile modulus, ² XY, XZ, YX, YZ	Type V	1800 MPa/261 ksi	ASTM D638
		Type I	1800 MPa/261 ksi	ASTM D638
	Tensile modulus, ² ZX, ZY	Type V	1800 MPa/261 ksi	ASTM D638
		Type I	1800 MPa/261 ksi	ASTM D638
	Elongation at break, ² XY, XZ, YX, YZ	Type V	50%	ASTM D638
		Type I	35%	ASTM D638
	Elongation at break, ² ZX, ZY	Type V	35%	ASTM D638
		Type I	25%	ASTM D638
	Elongation at Yield, XY, XZ, YX, YZ	Type V	25%	ASTM D638
		Type I	24%	ASTM D638
	Elongation at Yield, ZX, ZY	Type V	22%	ASTM D638
		Type I	20%	ASTM D638
	Flexural modulus, ³ XY, XZ, YX, YZ		1800 MPa/261 ksi	ASTM D790
	Flexural modulus, ³ ZX, ZY		1800 MPa/261 ksi	ASTM D790
	Flexural strength (@ 5%), ³ XY, XZ, YX, YZ		70 MPa/10150 psi	ASTM D790
	Flexural strength (@ 5%), ³ ZX, ZY		70 MPa/10150 psi	ASTM D790
Charpy impact notched (@23°C/73.4°F), XY, XZ, YX, YZ		5 kJ/m ²	ISO 179-1/1eA	
Charpy impact notched (@23°C/73.4°F), ZX, ZY		4.5 kJ/m ²	ISO 179-1/1eA	
Charpy impact unnotched (@23°C/73.4°F), XY, XZ, YX, YZ		125 kJ/m ²	ISO 179-1/1eU	
Charpy impact unnotched (@23°C/73.4°F), XY, XZ, YX, YZ		100 kJ/m ²	ISO 179-1/1eU	
Izod impact notched (@3.2 mm/0.126 in, 23°C/73.4°F), XY, XZ, YX, YZ		5.0 kJ/m ²	ASTM D256 Test Method A	
Izod impact notched (@3.2 mm/0.126 in, 23°C/73.4°F), ZX, ZY		4.5 kJ/m ²	ASTM D256 Test Method A	
Izod impact notched (@10 mm/0.394 in, 23°C/73.4°F), XY, XZ, YX, YZ		4 kJ/m ²	ASTM D256 Test Method A	

Category	Measurement	Specimen	Value	Method
Mechanical properties	Izod impact notched (@10 mm/0.394 in, 23°C/73.4°F), Z		3.5 kJ/m ²	ASTM D256 Test Method A
	Izod impact unnotched (@3.2 mm/0.126 in, 23°C/73.4°F), XY, XZ, YX, YZ		140 kJ/m ²	ASTM D256 Test Method A
	Izod impact unnotched (@3.2 mm/0.126 in, 23°C/73.4°F), ZX, ZY		110 kJ/m ²	ASTM D256 Test Method A
	Compression Modulus, XY, XZ, YX, YZ, ZX, ZY		1600 MPa/232 ksi	ASTM D695
	Compression Strength (@10%), XY, XZ, YX, YZ, ZX, ZY		60 MPa/8702 ksi	ASTM D695
	Rockwell – Ball Indentation Hardness (@100kg, Scale E), XY, XZ, YX, YZ, ZX, ZY		70	ASTM D785
	Shore Hardness D, XY, XZ, YX, YZ, ZX, ZY		80	ASTM D2240
	Roughness		8 µm	ASTM D7127
Thermal properties	Heat deflection temperature (@0.45 MPa, 66 psi), XY, XZ, YX, YZ		185°C/365°F	ASTM D648 Test Method A
	Heat deflection temperature (@0.45 MPa, 66 psi), ZX, ZY		185°C/365°F	ASTM D648 Test Method A
	Heat deflection temperature (@1.82 MPa, 264 psi), XY, XZ, YX, YZ		54°C/129°F	ASTM D648 Test Method A
	Heat deflection temperature (@1.82 MPa, 264 psi), ZX, ZY		54°C/129°F	ASTM D648 Test Method A
	Vicat softening temperature (@A-10N), XY, XZ, YX, YZ, ZX, ZY		185 °C/365 °F	ASTM D1525 Test rate A
	Vicat softening temperature (@A-50N), XY, XZ, YX, YZ, ZX, ZY		175 °C/347 °F	ASTM D1525 Test rate A

Coefficient of Linear Thermal Expansion (Test Method ASTM E831)

Coefficient thermal expansion [µm/(m °C)]		
Orientation	Measurement zone	
XY, XZ, YX, YZ	Below Tg	135
	Above Tg	225
ZX, ZY	Below Tg	115
	Above Tg	190

Tg temperature: 45°C / 113°F

Fast print mode

Technical specifications¹

Category	Measurement	Specimen	Value	Method
Mechanical properties	Tensile strength, max load, ² XY, XZ, YX, YZ	Type V	52 MPa/7542 psi	ASTM D638
		Type I	52 MPa/7542 psi	ASTM D638
	Tensile strength, max load, ² ZX, ZY	Type V	50 MPa/7252 psi	ASTM D638
		Type I	50 MPa/7252 psi	ASTM D638
	Tensile modulus, ² XY, XZ, YX, YZ	Type V	1800 MPa/261 ksi	ASTM D638
		Type I	1800 MPa/261 ksi	ASTM D638
	Tensile modulus, ² ZX, ZY	Type V	1800 MPa/261 ksi	ASTM D638
		Type I	1800 MPa/261 ksi	ASTM D638
	Elongation at break, ² XY, XZ, YX, YZ	Type V	50%	ASTM D638
		Type I	30%	ASTM D638
	Elongation at break, ² ZX, ZY	Type V	10%	ASTM D638
		Type I	10%	ASTM D638
	Elongation at Yield, XY, XZ, YX, YZ	Type V	25%	ASTM D638
		Type I	24%	ASTM D638
	Elongation at Yield, ZX, ZY	Type V	10%	ASTM D638
		Type I	10%	ASTM D638
	Flexural modulus, ³ XY, XZ, YX, YZ		1800 MPa/261 ksi	ASTM D790
	Flexural modulus, ³ ZX, ZY		1800 MPa/261 ksi	ASTM D790
	Flexural strength (@ 5%), ³ XY, XZ, YX, YZ		70 MPa/10152 psi	ASTM D790
	Flexural strength (@ 5%), ³ ZX, ZY		70 MPa/10152 psi	ASTM D790
Charpy impact notched (@23°C/73.4°F), XY, XZ, YX, YZ		5.0 kJ/m ²	ISO 179-1/1eA	
Charpy impact notched (@23°C/73.4°F), ZX, ZY		4.0 kJ/m ²	ISO 179-1/1eA	
Izod impact notched (@3.2 mm/0.126 in, 23°C/73.4°F), XY, XZ, YX, YZ		5.0 kJ/m ²	ASTM D256 Test Method A	
Izod impact notched (@3.2 mm/0.126 in, 23°C/73.4°F), ZX, ZY		4.5 kJ/m ²	ASTM D256 Test Method A	
Izod impact notched (@10 mm/0.394 in, 23°C/73.4°F), XY, XZ, YX, YZ		4.0 kJ/m ²	ASTM D256 Test Method A	
Izod impact notched (@10 mm/0.394 in, 23°C/73.4°F), ZX, ZY		3.5 kJ/m ²	ASTM D256 Test Method A	
Thermal properties	Heat deflection temperature (@0.45 MPa, 66 psi), XY, XZ, YX, YZ		185°C/365°F	ASTM D648 Test Method A
	Heat deflection temperature (@0.45 MPa, 66 psi), ZX, ZY		185°C/365°F	ASTM D648 Test Method A
	Heat deflection temperature (@1.82 MPa, 264 psi), XY, XZ, YX, YZ		55°C/131°F	ASTM D648 Test Method A
	Heat Deflection Temperature (@1.82 MPa, 264 psi), ZX, ZY		55°C/131°F	ASTM D648 Test Method A

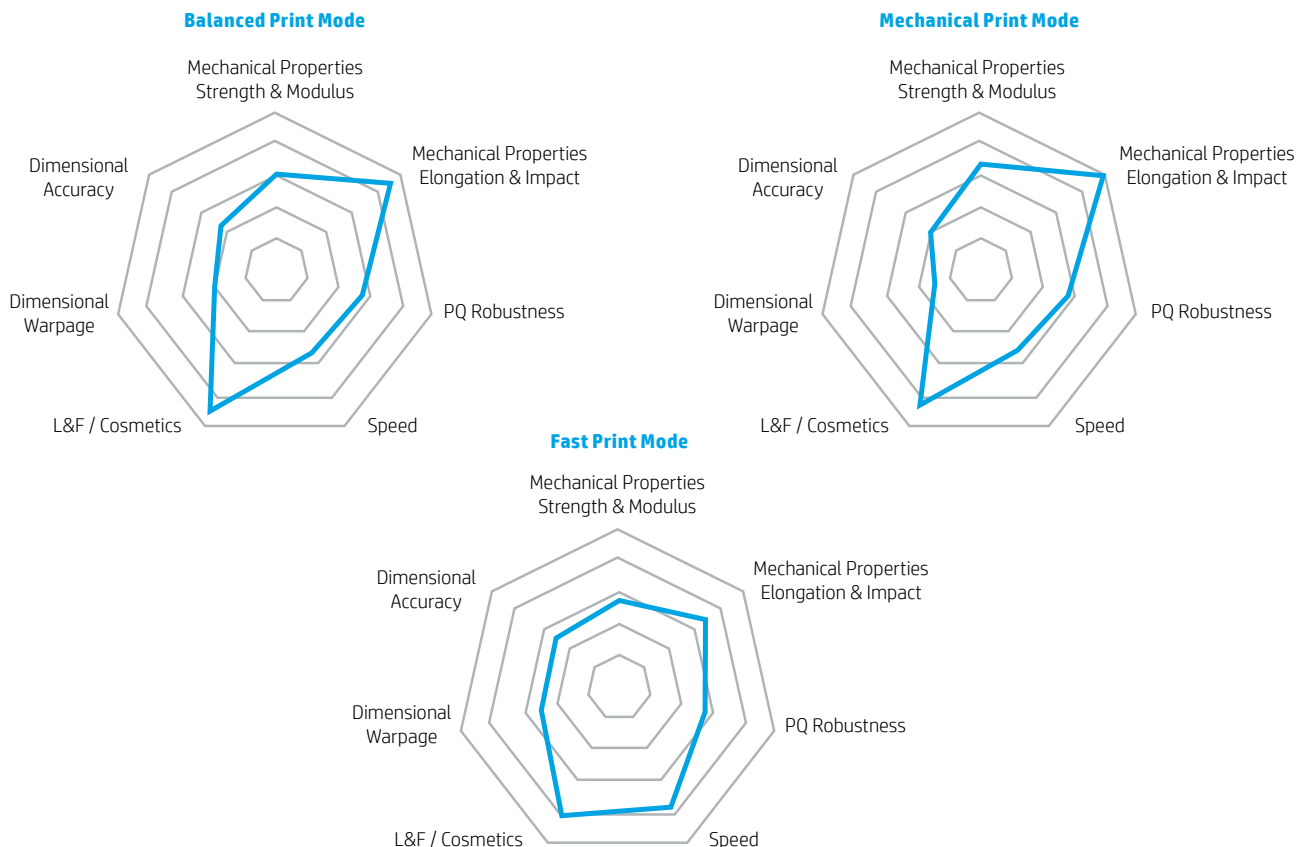
Mechanical print mode

Technical specifications¹

Category	Measurement	Specimen	Value	Method
Mechanical properties	Tensile strength, max load, ² XY, XZ, YX, YZ	Type V	52 MPa/7542 psi	ASTM D638
		Type I	52 MPa/7542 psi	ASTM D638
	Tensile strength, max load, ² ZX, ZY	Type V	52 MPa/7542 psi	ASTM D638
		Type I	52 MPa/7542 psi	ASTM D638
	Tensile modulus, ² XY, XZ, YX, YZ	Type V	1800 MPa/261 ksi	ASTM D638
		Type I	1800 MPa/261 ksi	ASTM D638
	Tensile modulus, ² ZX, ZY	Type V	1800 MPa/261 ksi	ASTM D638
		Type I	1800 MPa/261 ksi	ASTM D638
	Elongation at break, ² XY, XZ, YX, YZ	Type V	60%	ASTM D638
		Type I	40%	ASTM D638
	Elongation at break, ² ZX, ZY	Type V	50%	ASTM D638
		Type I	30%	ASTM D638
	Elongation at Yield, XY, XZ, YX, YZ	Type V	25%	ASTM D638
		Type I	24%	ASTM D638
	Elongation at Yield, ZX, ZY	Type V	22%	ASTM D638
		Type I	20%	ASTM D638
	Flexural modulus, ³ XY, XZ, YX, YZ		1700 MPa/247 ksi	ASTM D790
	Flexural modulus, ³ ZX, ZY		1700 MPa/247 ksi	ASTM D790
	Flexural strength (@ 5%), ³ XY, XZ, YX, YZ		65 MPa/9427 psi	ASTM D790
	Flexural strength (@ 5%), ³ ZX, ZY		65 MPa/9427 psi	ASTM D790
Charpy impact notched (@23°C/73.4°F), XY, XZ, YX, YZ		6 kJ/m ²	ISO 179-1/1eA	
Charpy impact notched (@23°C/73.4°F), ZX, ZY		5.5 kJ/m ²	ISO 179-1/1eA	
Izod impact notched (@3.2 mm/0.126 in, 23°C/73.4°F), XY, XZ, YX, YZ		5.5 kJ/m ²	ASTM D256 Test Method A	
Izod impact notched (@3.2 mm/0.126 in, 23°C/73.4°F), ZX, ZY		5.0 kJ/m ²	ASTM D256 Test Method A	
Izod impact notched (@10 mm/0.394 in, 23°C/73.4°F), XY, XZ, YX, YZ		5.0 kJ/m ²	ASTM D256 Test Method A	
Izod impact notched (@10 mm/0.394 in, 23°C/73.4°F), ZX, ZY		5.0 kJ/m ²	ASTM D256 Test Method A	
Thermal properties	Heat deflection temperature (@0.45 MPa, 66 psi), XY, XZ, YX, YZ		185°C/365°F	ASTM D648 Test Method A
	Heat deflection temperature (@0.45 MPa, 66 psi), ZX, ZY		185°C/365°F	ASTM D648 Test Method A
	Heat deflection temperature (@1.82 MPa, 264 psi), XY, XZ, YX, YZ		55°C/131°F	ASTM D648 Test Method A
	Heat deflection temperature (@1.82 MPa, 264 psi), ZX, ZY		55°C/131°F	ASTM D648 Test Method A

Print mode profiles

Profiles based on average XYZ values



Print mode comparison table

Profiles based on average XYZ values

	Speed	Mechanical properties	Look & feel	PQ Robustness	Dimensional accuracy	Dimensional warpage
Balanced	=	=	=	=	=	=
Mechanical	↓	↑	=	=	↓	=
Fast	↑	↓	=	=	↑	↑

Certifications

- USP Class I-VI
- US FDA guidance for Intact Skin Surface Devices

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For more information, please visit
hp.com/go/3DMaterials

1. The following technical information should be considered representative of averages or typical values and should not be used for specification purposes. These values are with FW TAGDAG_15_18_11.69 and have been obtained from a sample of specimens printed in plots with 6% packing density. Separation between specimens in the plot was 10 mm. Modulus has been calculated using the slope of the regression line between 0.05% and 0.25% strain measured with an automatic extensometer during the entire test. Cross-section dimension measures are done using a micrometer with round ends. Conditioning according to ASTM D618 Procedure A: 48 hours after printing and unpacking of the parts at 23°C/73°F and 50% RH. Orientations defined according to ASTM F2971.
2. Test results realized under the ASTM D638 with a test rate of 50 mm/min and 10 mm/min for type I and type V, respectively.
3. Test results realized under ASTM D790 Procedure B at a test rate of 13.55 mm/min.

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