HP 3D High Reusability (HR) PA 11

with the HP Jet Fusion 5200 Series 3D Printing Solution

Data courtesy of Bowman and OT4 Orthopädietechnik GmbH

HP 3D High Reusability PA 11—ideal for producing ductile[1], quality fuctional parts

Produce strong, ductile[1] functional parts

- Thermoplastic material delivering optimal mechanical properties
- Provides excellent chemical resistance[2] and enhanced elongation-at-break[1]
- Impact resistance and ductility[1] for prostheses, insoles, sports goods, snap fits, living hinges, and more
- Bio-compatibility: meets USP Class I-VI and US FDA guidance for Intact Skin Surface Devices[3]
- Meets strict automotive safety standards, including the Federal Motor Vehicle Safety Standard (FMVSS)[4]

Minimize waste with a quality bio-based material[5]

- Bio-based material[6], derived from vegetable castor oil, reduces your environmental impact
- Minimize waste—reuse surplus powder batch after batch and get functional parts without throwing away the excess anymore[7]
- Get consistent performance while achieving up to 70% surplus powder reusability[8]
- Optimize cost and part quality—cost-efficient material with industry-leading surplus powder reusability[7]

Engineered for HP Multi Jet Fusion technology and parts that reduce your carbon footprint[9]

- Uses biomethane for polymer production, which reduces the material's carbon footprint by 46%[9]
- Designed for production of functional and final parts across a variety of industries
- Provides the best balance between performance and reusability[10]
- Easy-to-process material enables high productivity and less waste[11]
- Engineered to reliably produce final parts and functional prototypes with fine detail and dimensional accuracy

General properties

	Value	Method
Powder melting point (DSC) (ºC / ºF)	202 / 396	ASTM D3418
Particle size (µm)	54	ASTM D3451
Bulk density of powder (g/cm³ / lb/in³)	0.48 / 0.017	ASTM 1895

Mechanical properties

This table shows the values that were obtained for HP 3D HR PA 11 in the HP Jet Fusion 5200 Series 3D Printing Solution, with PA 11 Balanced print profile and Type I tensile specimens, following the ASTM D638 standard.

HP 3D HR PA 11[i,ii,iii]	Axis	Average value	Method
Tensile Strength (MPa)[iv]	XY	54	ASTM D638
	Z	54	
Tensile Modulus (MPa)[iv]	XY	1700	ASTM D638
	Z	1800	
Elongation at Yield (%)	XY	25	ASTM D638
	Z	20	
Elongation at Break (%)	XY	40	ASTM D638
	Z	25	
Impact strength (kJ/m²)[v]	XY	7.0	ASTMD256
	Z	4.5	
Density (g/cm³)	XY	1.05	ASTMD792
	Z	1.05	

i. Based on internal testing and measured using the "HP Half_ Commercial_Datasheet_Job". Results may vary with other jobs and geometries.
ii. Using HP 3D HR PA 11 material, 30% refresh ratio, Balanced print profile, natural cooling, and measured after bead-blasting with glass beads at 5-6 bars.
iii. Following all HP-recommended printer setup and adjustment processes and printheads aligned using semi-automatic procedure.
iv. Tensile strength typical variation (95% of parts) falls within the 50-58 MPa range, while tensile modulus values remain within the 1500-2200 Mpa range.
v. Using the Izod test method A with notched @3.2 mm specimen according to the ASTM D256 standard.

Dimensional capabilities

Testing was performed for HP 3D HR PA 11 with 30% refresh ratio using the PA 11 Balanced print profile, natural cooling, and measured after bead-blasting with glass beads at 5-6 bars.
The table below shows the dimensional tolerances obtained during the characterization for a target process capability of Cpk= 1.33 (4 sigma).

Tolerances for C_{pk}= 1.33[i,ii,iii] (in mm)	Nominal dimension					
	0 - 30 mm		30 - 50 mm		50 - 80 mm	
	XY	Z	XY	Z	XY	Z
With the default setting for HP Jet Fusion 5200 Series 3D Printing Solutions	±0.30	±0.42	±0.36	±0.62	±0.44	±1.18

i. Based on Internal testing and measured using the HP dimensional capability characterization job. Results may vary with other jobs and geometries.
ii. Using HP 3D HR PA 11 material, 30% refresh ratio, Balanced print profile, natural cooling, and measured after bead-blasting with gloss beads at 5-6 bars.
iii. Following all HP recommended printer setup and adjustment processes and printheods aligned using semi-automatic procedure.

The table below shows the dimensional tolerances if the process capability target is set to Cpk = 1.00 (3 sigma).

Tolerances for C_{pk}= 1.00[i,ii,iii] (in mm)	Nominal dimension					
	0 - 30 mm		30 - 50 mm		50 - 80 mm	
	XY	Z	XY	Z	XY	Z
With the default setting for HP Jet Fusion 5200 Series 3D Printing Solutions	±0.26	±0.33	±0.31	±0.50	±0.37	±0.95

i. Based on internal testing and measured using the HP dimensional capability characterization job. Results may vary with other jobs and geometries.
ii. Using HP 3D HR PA 11 material, 30% refresh ratio. Balanced print profile. natural cooling, and measured after bead-blasting with gloss beads at 5-6 bars.
iii. Following all HP recommended printer setup and adjustment processes and printheods aligned using semi-automatic procedure.

Ordering information*

Product number	Material
V1R36A	HP 3D HR PA 11 300L /140 kg P Material
V1R24A	HP 3D HR PA 11 1700L/750 kg Material

*Available for HP Jet Fusion 5200 Series 3D Printing Solutions and the HP Jet Fusion 5000 3D Printer.

Safety datasheet*

Product number	Link to Safety Datasheet
V1R36A	HP 3D HR PA 11 300L /140 kg P Material
V1R24A	HP 3D HR PA 11 1700L/750 kg Material

*The link provided refer to US English version of the Safety Datasheet.

Other country specific Safety Datasheets are available here.
If you need more information please contact your HP AM representative.

1. Testing according to ASTM D638, ASTM D256, and ASTM D648 using HDT at different loads with a 3D scanner for dimensional accuracy. Testing monitored using statistical process controls.
2. For HP 3D High Reusability PA 11 based on internal HP testing, June 2017. Tested with diluted alkalies, concentrated alkalies, chlorine salts, alcohol, ester, ethers, ketones, aliphatic hydrocarbons, unleaded petrol, motor oil, aromatic hydrocarbons, toluene, and DOT 3 brake fluid. For HP 3D HR TPU01, based on testing by Forward AM, April 2020, according to ASTM D471 for select IRM oils and Fuel A.
3. HP has completed preliminary biocompatibility testing of printed parts deemed representative of those that would most likely be used for commercial purposes. The intent of this testing is to initially characterize the suitability of printed parts for certain regulated market applications affiliated with the HP 3D HR PA 11 material. For additional information, please contact your HP representative. Environmental Attributes and Regulatory Summary (EARS) document are available upon request. Please contact your HP representative to get the latest version.
4. This product is certified for Federal Motor Vehicle Safety Standard (FMVSS) 302 for Flammability of Interior Materials-Passenger Cars, Multipurpose Passenger Vehicles, Trucks, and Buses.
5. HP 3D High Reusability PA 11 powder is made with 100% renewable carbon content derived from castor plants grown without GMOs in arid areas that do not compete with food crops. HP 3D High Reusability PA 11 is made using renewable sources, and may be made together with certain non-renewable sources. A renewable resource is a natural organic resource that can be renewed at the same speed in which it is consumed. Renewable stands for the number of carbon atoms in the chain coming from renewable sources (in this case, castor seeds) according to ASTM D6866..
6. Bio-based raw material certified by Arkema.
7. Industry-leading surplus powder reusability, based on using HP 3D High Reusability PA 11 at recommended packing densities. Available for HP Jet Fusion 5200 Series 3D Printing Solutions.
8. HP Jet Fusion 3D Printing Solutions using HP 3D High Reusability PA 11 provide up to 70% powder reusability ratio, producing functional parts batch after batch. For testing, material is aged in real printing conditions and powder is tracked by generations (worst case for reusability). Parts are then made from each generation and tested for mechanical properties and accuracy.
9. Carbon footprint reduction calculated by Arkema.
10. Compared to selective laser sintering (SLS) technology. Providing an elongation at break XY of 50% with up to 70% powder reusability ratio according to the ASTM D638 test method. For testing, material is aged in real printing conditions and powder is tracked by generations (worst case for reusability). Parts are then made from each generation and tested for mechanical properties and accuracy.
11. Easier to process than standard HP 3D High Reusability PA 12, providing proper fusing along with good spreadability and compatibility due to its small particle size.

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