HP 3D High Reusability (HR) PA 12, enabled by Evonik

with the HP Jet Fusion 5600 Series 3D Printing Solution

HP 3D High Reusability PA 12, enabled by Evonik—ideal for producing strong, low-cost parts that reduce your carbon footprint[1]

Produce strong, functional, and detailed complex parts

- Robust thermoplastic produces high-density parts with balanced property profiles and strong structures
- Provides good chemical resistance to oils, greases, aliphatic hydrocarbons, and alkalies[2]
- Ideal for complex assemblies, housings, enclosures, and watertight applications
- 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]

Quality at a low cost per part[5]

- Achieve a low cost per part[5] and reduce your total cost of ownership[6]
- 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 80% 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[1]

- Uses renewable energy sources and biomethane for polymer production, which reduces the material's carbon footprint by 49%[1]
- Provides the best balance between performance and reusability[9]
- Achieves watertight properties without any additional post-processing
- Engineered to produce final parts and functional prototypes with fine detail and dimensional accuracy across a variety of industries

General properties

	Value	Method
Powder melting point (DSC) (°C / °F)	187 / 369	ASTM D3418
Particle size (µm)	60	ASTM D3451
Bulk density of powder (g/cm³ / lb/in³)	0.425 / 0.015	ASTM 1895

Mechanical properties

Test results for HP 3D HR PA 12, enabled by Evonik using Balanced Print Mode.

HP 3D HR PA 12, enabled by Evonik[i,ii,iii]	Axis	Average value	Method
Tensile Strength (MPa)[iv]	XY	54	ASTM D638
	Z	54	
Tensile Modulus (MPa)[iv]	XY	2150	ASTM D638
	Z	2150	
Elongation at Yield (%)	XY	11	ASTM D638
	Z	9	
Elongation at Break (%)	XY	18	ASTM D638
	Z	10	
Impact strength (kJ/m²)[v]	XY	4.5	ASTMD256
	Z	4.4	
Density (g/cm³)	XY	1.02	ASTMD792
	Z	1.02	

i. Based on internal testing and measured using the "HP Half_ Commercial_Datasheet_Job" and 2 material lots following material quality control guidelines. Results may vary with other geometries, jobs and, material lots and material conditions.
ii. Using HP 3D HR PA 12, enabled by Evonik material, 20% refresh ratio, Balanced print profile, natural cooling, and measured after bead-blasting with glass beads at 5-6 bars. Results can be adjusted by using HP 3D Process Development.
iii. Following all HP-recommended printer setup and adjustment processes and printheads aligned.
iv. Tensile strength typical variation (95% of parts) falls within the 50 to 56 MPa range, while tensile modulus values remain within the 2000 to 2300 Mpa range.
v. Using the Izod test method A with notched @ 3.2 mm specimen according to the ASTM D256 standard.

Balanced Print Mode Comparision Across MJF Solutions

The below table highlights the mechanical property variation improvements of the 5600 in comparision with previous MJF solutions (95% of parts fall within these ranges). Further improvements are possible using HP 3D Process Development.

HP 3D HR PA 12, enabled by Evonik	4200	5200	5600
Tensile Strength (MPa)	45-55	45-55	50-56
Tensile Modulus (MPa)	1500-2100	1650-2200	2000-2300

Dimensional capabilities

The following results were based on internal testing using the Test Job. Results may vary with other jobs and geometries. Testing was performed for HP 3D PA 12, enabled by Evonik with a 20% refresh ratio using the PA 12 Balanced print profile, natural cooling, and measured after bead-blasting with glass beads at 5-6 bars. All HP-recommended printer setup and adjustment processes were following and printheads were aligned.

This table 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 (in mm)	Nominal dimension					
	0 - 30 mm		30 - 50 mm		50 - 80 mm	
	XY	Z	XY	Z	XY	Z
With the general dimensional profile for the HP Jet Fusion 5600 Series 3D Printing Solution	±0.20	±0.42	±0.25	±0.50	±0.30	±0.60

This table shows the dimensional tolerances obtained during the characterization for a target process capability of Cpk = 1.00 (3 sigma).

Tolerances for C_{pk}= 1.00 (in mm)	Nominal dimension					
	0 - 30 mm		30 - 50 mm		50 - 80 mm	
	XY	Z	XY	Z	XY	Z
With the general dimensional profile for the HP Jet Fusion 5600 Series 3D Printing Solution	±0.15	±0.34	±0.18	±0.40	±0.22	±0.47

Ordering information*

Product number	Material
V1R20A	HP 3D HR PA 12 1400L /600 kg Material
V1R16A	HP 3D HR PA 12 300L/130 kg Material
V1R34A	HP 3D HR PA 12 300L/130 kg P Material

*Compatible with the HP Jet Fusion 5600 Series 3D Printing Solution, the HP Jet Fusion 5200 Series 3D Printing Solution, and the HP Jet Fusion 5000 3D Printer.

Safety datasheet*

Product number	Link to Safety Datasheet
V1R20A	HP 3D HR PA 12 1400L /600 kg Material
V1R16A	HP 3D HR PA 12 300L/130 kg Material
V1R34A	HP 3D HR PA 12 300L/130 kg P 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. Carbon footprint reduction calculated by Evonik.
2. For HP 3D High Reusability PA 12, enabled by Evonik 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.
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 12, enabled by Evonik 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. Based on internal testing and public data for solutions on market as of April, 2016. Cost analysis based on: standard solution configuration price, supplies price, and maintenance costs recommended by manufacturer. Cost criteria: printing 1.4 full build chambers of parts per day/5 days per week over 1 year of 30 cm^3 parts at 10% packing density on Fast print mode using HP 3D High Reusability PA 12, enabled by Evonik material, and the powder reusability ratio recommended by manufacturer, and printing under certain build conditions and part geometries.
6. Compared to selective laser sintering (SLS) and fused deposition modeling (FDM) technologies, HP Multi Jet Fusion technology can reduce the overall energy requirements needed to attain full fusing and reduce the system requirements for large, vacuum-sealed ovens. In addition, HP Multi Jet Fusion technology uses less heating power than SLS systems for better material properties and material reuse rates, minimizing waste.
7. Industry-leading surplus powder reusability, based on using HP 3D High Reusability PA 12, enabled by Evonik at recommended packing densities.
8. HP Jet Fusion 3D Printing Solutions using HP 3D High Reusability PA 12, enabled by Evonik provide up to 80% 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. Compared to selective laser sintering (SLS) technology. Tested according to ASTM D638, ASTM D256, ASTM D790, and ASTM D648.

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