

# HP 3D High Reusability PA 11

Ductile,<sup>1</sup> quality parts



## Produce strong, ductile,<sup>1</sup> functional parts

- Thermoplastic material delivering optimal mechanical properties.
- Provides excellent chemical resistance<sup>2</sup> and enhanced elongation-at-break.<sup>1</sup>
- Impact resistance and ductility<sup>1</sup> for prostheses, insoles, sports goods, snap fits, living hinges, and more.

## Minimize waste with a renewable raw material<sup>3</sup>

- Renewable raw material from vegetable castor oil (reduced environmental impact).<sup>3</sup>
- Minimize waste—reuse surplus powder batch after batch and get functional parts, no throwing away anymore.<sup>4</sup>
- Get consistent performance while achieving 70% surplus powder reusability.<sup>5</sup>
- Optimize cost and part quality—cost-efficient material with industry-leading surplus powder reusability.<sup>4</sup>

## Engineered for HP Multi Jet Fusion technology

- Designed for production of functional and final parts across a variety of industries.
- Provides the best balance between performance and reusability.<sup>6</sup>
- Easy-to-process material enables high productivity and less waste.<sup>7</sup>
- Engineered to reliably produce final parts and functional prototypes with fine detail, dimensional accuracy.



3D data courtesy of NACAR

## Performance results for HP 3D HR PA 11

Testing was performed for HP 3D HR PA 11 with a 30% refresh ratio using the PA 11 Balanced print profile, natural cooling, and measured after bead-blasting with glass beads at 5-6 bars.

Table 1 shows the dimensional tolerances obtained during the characterization for a target process capability of  $C_{pk} = 1.33$  (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>i. Based on internal testing and measured using the HP dimensional capability characterization job. Results may vary with other jobs and geometries.</i> <i>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.</i> <i>iii. Following all HP recommended printer setup and adjustment processes and printheads aligned using semi-automatic procedure.</i>						

Table 1. Dimensional capabilities for HP 3D HR PA 11. Target process capability of  $C_{pk} = 1.33$ .

Table 2 shows the dimensional tolerances if the process capability target is set to  $C_{pk} = 1.00$  (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>i. Based on internal testing and measured using the HP dimensional capability characterization job. Results may vary with other jobs and geometries.</i> <i>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.</i> <i>iii. Following all HP recommended printer setup and adjustment processes and printheads aligned using semi-automatic procedure.</i>						

Table 2. Dimensional capabilities for HP 3D HR PA 11. Target process capability of  $C_{pk} = 1.00$ .

# Technical specifications<sup>8</sup>

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 <sup>3</sup> /0.017 lb/in <sup>3</sup>	ASTM D1895
	Density of parts	1.05 g/cm <sup>3</sup> /0.038 lb/in <sup>3</sup>	ASTM D792
Mechanical properties	Tensile strength, max load, <sup>9</sup> XY, XZ, YX, YZ	52 MPa/7542 psi	ASTM D638
	Tensile strength, max load, <sup>9</sup> ZX, ZY	52 MPa/7542 psi	ASTM D638
	Tensile modulus, <sup>9</sup> XY, XZ, YX, YZ	1800 MPa/261 ksi	ASTM D638
	Tensile modulus, <sup>9</sup> ZX, ZY	1800 MPa/261 ksi	ASTM D638
	Elongation at break, <sup>9</sup> XY, XZ, YX, YZ	50%	ASTM D638
	Elongation at break, <sup>9</sup> ZX, ZY	35%	ASTM D638
	Flexural strength (@ 5%), <sup>10</sup> XY, XZ, YX, YZ, ZX, ZY	70 MPa/10150 psi	ASTM D790
	Flexural modulus, <sup>10</sup> XY, XZ, YX, YZ, ZX, ZY	1800 MPa/261 ksi	ASTM D790
	Izod impact notched (@ 3.2 mm, 23°C), XY, XZ, YX, YZ	5 kJ/m <sup>2</sup>	ASTM D256 Test Method A
	Izod impact notched (@ 3.2 mm, 23°C), ZX, ZY	4.5 kJ/m <sup>2</sup>	ASTM D256 Test Method A
	Shore Hardness D, XY, XZ, YX, YZ, ZX, ZY	80	ASTM D2240
Thermal properties	Heat deflection temperature (@ 0.45 MPa, 66 psi), XY, XZ, YX, YZ, ZX, ZY	185 °C/365 °F	ASTM D648 Test Method A
	Heat deflection temperature (@ 1.82 MPa, 264 psi), XY, XZ, YX, YZ, ZX, ZY	54 °C/129 °F	ASTM D648 Test Method A
Reusability	Refresh ratio for stable performance	30%	
Recommended environmental conditions	Recommended relative humidity	50-70% RH	
Certifications	USP Class I-VI and US FDA guidance for Intact Skin Surface Devices <sup>11</sup>		

## Ordering information

	HP 3D High Reusability PA 11 <sup>12</sup>	HP 3D High Reusability PA 11 <sup>12</sup>	HP 3D High Reusability PA11 Production Material <sup>12</sup>
Product number	V1R12A	V1R18A	V1R36A
Weight	14 kg/30.9 lb	140 kg/308.6 lb	140 kg/308.6 lb
Capacity	30L <sup>13</sup>	300L <sup>13</sup>	300L <sup>13</sup>
Dimensions (xyz)	600 x 333 x 302 mm	800 x 600 x 1205 mm	800 x 600 x 1205 mm
Printer compatibility	HP Jet Fusion 3D 4210/4200 Printing Solution	HP Jet Fusion 3D 4210/4200 Printing Solution	HP Jet Fusion 3D 4210 Printing Solution
Fast cooling compatibility	Not recommended	Not recommended	Not recommended

### Eco Highlights



- Powders and agents are not classified as hazardous<sup>14</sup>
- Cleaner, more comfortable workplace—enclosed printing system, and automatic powder management<sup>15</sup>
- Minimizes waste due to industry-leading reusability of powder<sup>16</sup>

Find out more about HP sustainable solutions at [hp.com/go/ecosolutions](http://hp.com/go/ecosolutions)

Dynamic security enabled printer. Only intended to be used with cartridges using an HP original chip. Cartridges using a non-HP chip may not work, and those that work today may not work in the future.

More at: [hp.com/go/learnaboutesupplies](http://hp.com/go/learnaboutesupplies)

For more information, please visit

[am3d.pl](http://am3d.pl)

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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. 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 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.
4. Based on using recommended packing densities and compared to selective laser sintering (SLS) technology, offers excellent reusability without sacrificing mechanical performance. Tested according to ASTM D638, ASTM D256, ASTM D790, and ASTM D648 and using a 3D scanner for dimensional accuracy. Testing monitored using statistical process controls.
5. HP Jet Fusion 3D Printing Solutions using HP 3D High Reusability PA 11 provide 70% post-production surplus powder reusability, producing functional parts batch after batch. For testing, material is aged in real printing conditions and powder is tracked by generations (worst case for recyclability). Parts are then made from each generation and tested for mechanical properties and accuracy.
6. Compared to selective laser sintering (SLS) technology. Providing an elongation at break XY of 50% with 70% post-production surplus powder reusability 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 recyclability). Parts are then made from each generation and tested for mechanical properties and accuracy.
7. 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.
8. 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 TATDAG\_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 obtained 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.
9. Test results realized under the ASTM D638 with a test rate of 10 mm/min, specimens type V.
10. Test results realized under ASTM D790 Procedure B at a test rate of 13.55 mm/min.
11. Based on HP internal testing, June 2017, HP 3D600 Fusing and Detailing Agents and HP 3D High Reusability PA 11 powder meet USP Class I-VI and US FDA's guidance for Intact Skin Surface Devices. Tested according to USP Class I-VI including irritation, acute systemic toxicity, and implantation; cytotoxicity per ISO 10993-5, Biological evaluation of medical devices—part 5: Tests for in vitro cytotoxicity; and sensitization per ISO 10993-10, Biological evaluation of medical devices—Part 10: Tests for irritation and skin sensitization. It is the responsibility of the customer to determine that its use of the fusing and detailing agents and powder is safe and technically suitable to the intended applications and consistent with the relevant regulatory requirements (including FDA requirements) applicable to the customer's final product. For more information, see [hp.com/go/biocompatibilitycertificate/PA11](http://hp.com/go/biocompatibilitycertificate/PA11).
12. Available in the second half of 2018.
13. Liters refers to the materials container size and not the actual materials volume. Materials are measured in kilograms.
14. The HP powder and agents do not meet the criteria for classification as hazardous according to Regulation (EC) 1272/2008 as amended.
15. Compared to manual print retrieval process used by other powder-based technologies. The term "cleaner" does not refer to any indoor air quality requirements and/or consider related air quality regulations or testing that may be applicable.
16. Compared to PA 11 materials available as of June, 2017. HP Jet Fusion 3D Printing Solutions using HP 3D High Reusability PA 11 provide 70% post-production surplus powder reusability, producing functional parts batch after batch.

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