



# Polyamide family

## Material selection

### Introduction

HP is working hard to enable new materials innovations that break down some of the traditional barriers to 3D printing adoption—cost, quality performance, and diversity.

Therefore, a selected range of polyamide-based materials has been engineered for HP Multi Jet Fusion technology, thus offering engineering-grade thermoplastics that provide optimal output quality and high reusability at a low cost per part.<sup>1</sup>

### HP 3D Printing polyamide-based materials for the HP Jet Fusion 4200 3D Printing Solution and the HP Jet Fusion 5200 Series 3D Printing Solution

HP 3D Printing polyamide-based materials for the HP Jet Fusion 4200 3D Printing Solution and the HP Jet Fusion 5200 Series 3D Printing Solution include HP 3D High Reusability<sup>1</sup> PA 12 (HP 3D HR PA 12), HP 3D High Reusability<sup>2</sup> PA 12 Glass Beads (HP 3D HR PA 12 GB), and HP 3D High Reusability<sup>3</sup> PA 11 (HP 3D HR PA 11).

#### HP 3D HR PA 12: Ideal for producing strong, functional, detailed complex parts

- Robust thermoplastic that produces high-density parts with balanced property profiles and strong structures.
- Provides excellent chemical resistance to oils, greases, aliphatic hydrocarbons, and alkalis.<sup>4</sup>
- Meets biocompatibility certifications such as USP Class I-VI and US FDA guidance for Intact Skin Surface Devices.<sup>5</sup>
- Provides the best balance between performance and cost compared with other HP 3D Printing polyamide-based materials.
- Engineered to produce final parts and functional prototypes with fine detail and dimensional accuracy, and designed for the production of functional parts across a variety of industries.
- Ideal for complex assemblies, housings, enclosures, and watertight applications, achieving watertight properties without any additional post-processing.
- Compatible with the HP Jet Fusion 4200 3D Printing Solution and the HP Jet Fusion 5200 Series 3D Printing Solutions.



Figure 1: HP 3D HR PA 12 part after graphite blasting post-processing

#### HP 3D HR PA 12 Glass Beads: Ideal for producing stiff, functional parts

- 40% glass bead-filled thermoplastic material with both optimal mechanical properties and high reusability.<sup>6</sup>
- Provides dimensional stability as well as repeatability.<sup>7</sup>
- Engineered to produce common glass bead applications with detail and dimensional accuracy, and designed for production of functional parts across a variety of industries.
- Ideal for applications requiring high stiffness like enclosures, housings, fixtures, and tooling.
- Compatible with the HP Jet Fusion 4200 3D Printing Solution and the HP Jet Fusion 5200 Series 3D Printing Solution.



Figure 2: HP 3D HR PA 12 GB part courtesy of NACAR

## HP 3D HR PA 11: Ideal for producing strong, ductile,<sup>8</sup> functional parts

- Thermoplastic material with renewable raw material from vegetable castor oil (reduced environmental impact).<sup>8</sup> It delivers optimal mechanical properties, providing an excellent chemical resistance<sup>4</sup> and enhanced elongation-at-break.<sup>7</sup>
- Easy-to-process material that enables high productivity and less waste.<sup>9</sup>
- Engineered to reliably produce final parts and functional prototypes with fine detail and dimensional accuracy, and designed for the production of functional and final parts across a variety of industries.
- Provides impact resistance and ductility<sup>7</sup> for prostheses, insoles, sporting goods, snap-fits, living hinges, and more.
- Compatible with the HP Jet Fusion 4200 3D Printing Solution and the HP Jet Fusion 5200 Series 3D Printing Solution.



Figure 3: HP 3D HR PA 11 part courtesy of NACAR

The mechanical properties of HP 3D HR PA 12, HP 3D HR PA 12 GB, and HP 3D HR PA 11 in the HP Jet Fusion 4200 3D Printing Solution and the HP Jet Fusion 5200 Series 3D Printing Solution have been characterized in the [HP 3D Printing materials for the HP Jet Fusion 4200 3D Printing Solution – Mechanical Properties](#) and [HP 3D Printing materials for the HP Jet Fusion 5200 Series 3D Printing Solution – Mechanical Properties](#) white papers, respectively.

## HP 3D Printing polyamide-based materials for HP Jet Fusion 500 Series 3D Printers

HP 3D Printing polyamide-based materials for HP Jet Fusion 500 Series 3D Printers include HP 3D High Reusability (HR)<sup>10</sup> CB PA 12.

### HP 3D HR CB PA 12: engineering-grade, full-color,<sup>11</sup> and white parts

- A robust thermoplastic that produces high-density parts with balanced property profiles and strong structures.
- Provides excellent chemical resistance to oils, greases, aliphatic hydrocarbons, and alkalis.<sup>4</sup>
- Designed for the production of full-color<sup>11</sup> and white functional parts across a variety of industries.
- Ideal for color<sup>11</sup> and white parts like jigs, fixtures, labeling, presentation models, and functional prototypes.

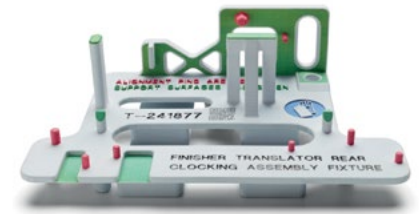


Figure 4: HP 3D HR CB PA 12 part

The mechanical properties of HP 3D HR CB PA 12 white parts and colored parts in the HP Jet Fusion 500 Series 3D Printers have been characterized in the [HP 3D HR CB PA 12 for HP Jet Fusion 500 Series 3D Printers – Mechanical Properties](#) white paper.

**For more information please visit:**  
[hp.com/go/3Dmaterials](http://hp.com/go/3Dmaterials)

1. HP Jet Fusion 3D Printing Solutions using HP 3D High Reusability PA 12 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.
2. HP Jet Fusion 3D Printing Solutions using HP 3D High Reusability PA 12 Glass Beads 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.
3. 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 accuracies.
4. 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<sup>3</sup> parts at 10% packing density on fast print mode using HP 3D High Reusability PA 12 material, and the powder reusability ratio recommended by manufacturer, and printing under certain build conditions and part geometries.
5. Tested with diluted alkalis, concentrated alkalis, chlorine salts, alcohol, ester, ethers, ketones, aliphatic hydrocarbons, unleaded petrol, motor oil, aromatic hydrocarbons, toluene, and DOT 3 brake fluid.
6. Based on HP internal testing, June 2017, HP 3D600/3D700/3D710 Fusing and Detailing Agents and HP 3D High Reusability PA 12 and HP 3D High Reusability PA 11 powders 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/3Dmaterials](http://hp.com/go/3Dmaterials).
7. Based on using recommended packing densities, offers high reusability of surplus powder. Liters refers to the materials container size and not the actual materials volume. Materials are measured in kilograms.
8. Testing according to ASTM D638, ASTM D256, and ASTM D648 using HDT at different loads with a 3D scanner. Testing monitored using statistical process controls.
9. 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.
10. 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.
11. Full color parts applicable only with the HP Jet Fusion 580 Color 3D Printer.

©Copyright 2019 – 2020 HP Development Company, L.P. The information contained herein is subject to change without notice.

The information contained herein is provided for information purposes only. The only terms and conditions governing the sale of HP 3D printer solutions are those set forth in a written sales agreement. The only warranties for HP products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty or additional binding terms and conditions. HP shall not be liable for technical or editorial errors or omissions contained herein and the information herein is subject to change without notice.

