# HP 3D Printing materials


# Breaking down the barriers to 3D printing adoption through materials innovation

Leading the charge into a new era of digital manufacturing, HP 3D Printing solutions are providing new opportunities for businesses and industries. HP Multi Jet Fusion technology disrupts the status quo with a solution that can transform part properties voxel by voxel—enabling a future of limitless applications and materials. Imagine a future where we can produce 'Smart Parts' with embedded electronics and integrated traceability and intelligence. Materials innovation is at the heart of making this vision a reality. To help your business get ready for a future era of digital manufacturing, 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. HP is doing this through a growing portfolio of HP-branded powders and materials certified for HP Jet Fusion 3D Printing.

# HP 3D Printing materials for HP Jet Fusion 5000 3D Printer and HP Jet Fusion 4200/5200/5600 Series 3D Printing Solution

In addition to our flagship material—HP 3D High Reusability PA 12 enabled by Evonik, HP is expanding its portfolio of thermoplastics. Powders, such as HP 3D High Reusability PA 12 Glass Beads and HP 3D High Reusability PA 11, deliver optimal mechanical properties. Engineered for HP Multi Jet Fusion technology, these materials test the limits of functional part creation, optimizing cost and part quality while also delivering high[1] and, in many cases, industry-leading reusability[2] at a low cost per part[3]. HP 3D High Reusability PP, enabled by BASF[4], provides our best value HP 3D material and delivers consistent performance with up to 90% surplus powder reuse[5]. We've also added HP 3D High Reusability TPA, enabled by Evonik[6], which produces flexible and lightweight[7] parts with enhanced rebound resilience using an easy-to-process elastomer, ensuring high part uniformity.

Our latest addition to the portfolio, Estane 3D TPU M88A, produces flexible, durable, and lightweight parts suited for skin contact.

## Introducing HP 3D HR PA 12 S, enabled by Arkema.

This is for customers who need to produce premium surface parts with up to 25% lower variable costs,[48] while minimizing waste through high reusability[49], leading to reduced environmental impact.

# HP 3D High Reusability PA 11—ideal for producing ductile[8], quality fuctional parts

## Produce strong, ductile[8] functional parts

- Thermoplastic material delivering optimal mechanical properties
- Provides excellent chemical resistance[9] and enhanced elongation-at-break[8]
- Impact resistance and ductility[8] 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[10]
- Meets strict automotive safety standards, including the Federal Motor Vehicle Safety Standard (FMVSS)[11]

## Minimize waste with a quality bio-based material[12]

- Bio-based material[13], 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[2]
- Get consistent performance while achieving up to 70% surplus powder reusability[14]
- Optimize cost and part quality—cost-efficient material with industry-leading surplus powder reusability[2]

## Engineered for HP Multi Jet Fusion technology and parts that reduce your carbon footprint[15]

- Uses biomethane for polymer production, which reduces the material's carbon footprint by 46%[15]
- Designed for production of functional and final parts across a variety of industries
- Provides the best balance between performance and reusability[16]
- Easy-to-process material enables high productivity and less waste[17]
- Engineered to reliably produce final parts and functional prototypes with fine detail and dimensional accuracy

| | Value | Method |
|---|---|---|
| Powder melting point (DSC) | 202°C<br>396°F | ASTM D3418 |
| Particle size | 54 µm | ASTM D3451 |
| Bulk density of powder | 0.48 g/cm$^3$<br>0.017 lb/in$^3$ | ASTM D1895 |

Data courtesy of OT4 Orthopädietechnik GmbH

Data courtesy of Bowman - additive production

# HP 3D High Reusability PA 12, enabled by Evonik—ideal for producing strong, low-cost parts that reduce your carbon footprint[18]

## 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[9]
- 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[10]
- Meets strict automotive safety standards, including the Federal Motor Vehicle Safety Standard (FMVSS)[11]

## Quality at a low cost per part[3]

- Achieve a low cost per part[3] and reduce your total cost of ownership[19]
- Minimize waste—reuse surplus powder batch after batch and get functional parts without throwing away the excess anymore[2]
- Get consistent performance while achieving up to 80% surplus powder reusability[20]
- Optimize cost and part quality—cost-efficient material with industry-leading surplus powder reusability[2]

## Engineered for HP Multi Jet Fusion technology and parts that reduce your carbon footprint[18]

- Uses renewable energy sources and biomethane for polymer production, which reduces the material's carbon footprint by 49%[18]
- Provides the best balance between performance and reusability[21]
- 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

| | Value | Method |
|---|---|---|
| Powder melting point (DSC) | 187°C<br>369°F | ASTM D3418 |
| Particle size | 60 µm | ASTM D3451 |
| Bulk density of powder | 0.425 g/cm$^3$<br>0.015 lb/in$^3$ | ASTM D1895 |

Data courtesy of Invent Medical

Data courtesy of Skorpion Engineering Srl

# HP 3D High Reusability PA 12 S, enabled by Arkema— ideal for producing premium surface aesthetics with a lower cost per part[51] and high reusability[52]

## Produce quality parts with premium surface aesthetics

- Achieve premium surface aesthetic parts directly from the printer that are up to 70% smoother[50], thanks to unique particle shapes and narrow particle size distribution, which makes it ideal for when exceptionally smooth surfaces are required
- Produce functional prototypes and final parts with fine detail and dimensional accuracy across a variety of industries
- Deliver smooth and accurate molds for clear aligners, ideal for dental applications. No additional post-processing needed to attain clean surfaces and enhanced transparency
- Gain versatility to produce a broad range of parts, including industrial and consumer goods. Extend your reach into lighting, merchandising/promotional items, volume prototyping, jigs and fixtures, and eye-catching covers

## Achieve an even lower cost per part[51]

- Reduce variable cost per part and your total cost of ownership[48]
- Get consistent performance while achieving up to 85% surplus powder reusability with this low reactive material[49]
- Optimize production with HP Multi Jet Fusion technology, which streamlines post-processing to help save time and reduce costs. Minimize tumbling post processing and still achieve smooth end products

## Minimize waste and embrace recyclability

- Maximize powder efficiency with an 85% reusability ratio and optimize usage, allowing for continuous printing and a reduced environmental impact[51]
- Embrace a circular economy with Arkema's Virtucycle recycling program. Grant a second life to polymer waste powder and printed parts, fostering sustainability and environmental responsibility[52]

Data courtesy of Bega

Data courtesy of Decathlon

# HP 3D High Reusability PA 12 Glass Beads—ideal for producing stiff, dimensionally stable, quality parts

## Produce stiff, functional parts

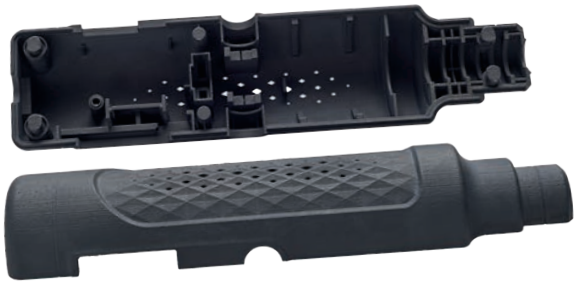
- 40% glass bead-filled thermoplastic material with both optimal mechanical properties and high reusability[1]
- Provides dimensional stability along with repeatability[22]
- Ideal for applications requiring high stiffness, like enclosures and housings, fixtures and tooling

## Quality and high reusability[1]

- Less waste—reuse surplus powder batch after batch and get functional parts without throwing away the excess anymore[1]
- Get consistent performance while achieving up to 70% surplus powder reusability[23]
- Glass beads come from recycled glass
- Optimize cost and part quality—cost-efficient material with high surplus powder reusability[1]

## Engineered for HP Multi Jet Fusion technology

- Designed for production of functional parts across a variety of industries
- Provides the best balance between performance and reusability[24]
- Engineered to produce common glass bead applications with fine detail and dimensional accuracy



| | Value | Method |
|---|---|---|
| Powder melting point (DSC) | 186°C<br>367°F | ASTM D3418 |
| Particle size | 58 µm | ASTM D3451 |
| Bulk density of powder | 0.48 g/cm$^3$<br>0.017 lb/in$^3$ | ASTM D1895 |

Data courtesy of Prometal3D

# HP 3D High Reusability PP, enabled by BASF[4]—ideal for producing chemical-resistant[25], weldable, low moisture absorption, functional parts

## Genuine, functional PP parts

- Get the same properties as many commonly used PPs with this genuine polypropylene material
- Accelerate your product development process using the same prototyping material as the final part
- Bio-compatibility—meets ISO 10993 and US FDA guidance for Intact Skin Surface Devices Statements[10]
- Meets strict automotive safety standards, including the Federal Motor Vehicle Safety Standard (FMVSS)[11]

## Chemical resistance[25], low moisture absorption

- Excellent chemical resistance and low moisture absorption ideal for piping or fluid systems, and containers[25]
- Outstanding welding capabilities with other PP parts produced with traditional methods, like injection molding
- Versatile material ideal for a wide range of automotive, industrial, consumer goods, and medical[10] applications

## Lowest cost HP 3D material for HP Multi Jet Fusion

- Our best value HP 3D material delivers consistent performance with up to 90% surplus powder reuse[5]
- Provides the optimal balance between performance and cost[26]
- Easy-to-process material enables high productivity and less waste[17]

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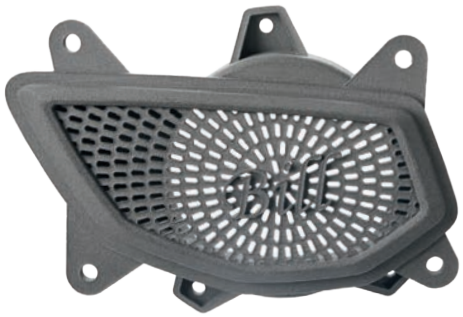
| | Value | Method |
|---|---|---|
| Powder melting point (DSC) | 138°C<br>280°F | ASTM D3418 |
| Particle size | 62 µm | ASTM D3451 |
| Bulk density of powder | 0.34 g/cm$^3$<br>0.012 lb/in$^3$ | ASTM D1895 |



Printed with HP 3D High Reusability PP, enabled by BASF

Printed with HP 3D High Reusability PP, enabled by BASF

# HP 3D High Reusability TPA, enabled by Evonik—ideal for producing easy-to-process, flexible, and lightweight parts

## Flexible and lightweight parts with enhanced rebound resilience

- Enhanced rebound resilience and elongation-at-break with lighter parts
- Optimal mechanical resistance at low temperature
- Ideal for applications like winter sports equipment, car interiors, robotics and grippers, and fluid systems

## Elastomer with high part uniformity

- A flexible polyamide (PA)—one of the most used additive manufacturing materials—in a thermoplastic elastomer
- High level of detail and color uniformity

## Easy to process

- Smooth workflow is comparable to using other PAs, with a simple printing process and easy clean-up of complex parts
- Fastest time-to-part compared to other HP 3D Printing materials[28]
- Robust parts withstand the cleaning process
- Get consistent performance while achieving 80% surplus powder reusability[28]


Data courtesy of GoProto Inc. Printed with HP 3D High Reusability TPA, enabled by Evonik.

| | Value | Method |
|---|---|---|
| Powder melting point (DSC) | 152°C<br>305.6°F | ASTM D3418 |
| Particle size | 77 µm | ASTM D3451 |
| Bulk density of powder | 0.420 g/cm$^3$<br>0.015 lb/in$^3$ | ASTM D1895 |

# HP 3D Printing material for HP Jet Fusion 5400 Series 3D Printing Solution

## Expand your offerings with quality white applications

HP 3D High Reusability PA 12 W—ideal for engineering-grade, white, quality functional production parts.

### Strong, functional complex parts

- Robust thermoplastic produces high-density parts with balanced property profiles and strong structures
- Ideal for white parts like prosthetics, medical equipment, lighting décor, fashion and wearables, and household appliances

### Quality white parts

- Produce functional white parts with optimal mechanical properties
- Get consistent performance while achieving up to 75% surplus powder reusability[29]
- Optimize cost and quality—white functional parts and industry-leading reusability[30]

### Engineered for HP Multi Jet Fusion technology

- Designed for production of white functional parts across a variety of industries, including healthcare and consumer goods
- Provides the best balance between white performance and reusability[31]
- Engineered to produce functional prototypes with fine detail and dimensional accuracy

| | Value | Method |
|---|---|---|
| Powder melting point (DSC) | 188°C<br>370°F | DIN EN ISO 11357 |
| Particle size (D50) | 57 µm | DIN EN ISO 8130/13 |
| Bulk density of powder | 0.435 g/cm$^3$<br>0.015 lb/in$^3$ | ISO 60 |

Data courtesy of Invent Medical

Data courtesy of Castomade

Data courtesy of Ed Lighting

# Providing reassurance

## HP 3D Printing materials comply with a number of recognized health and safety standards

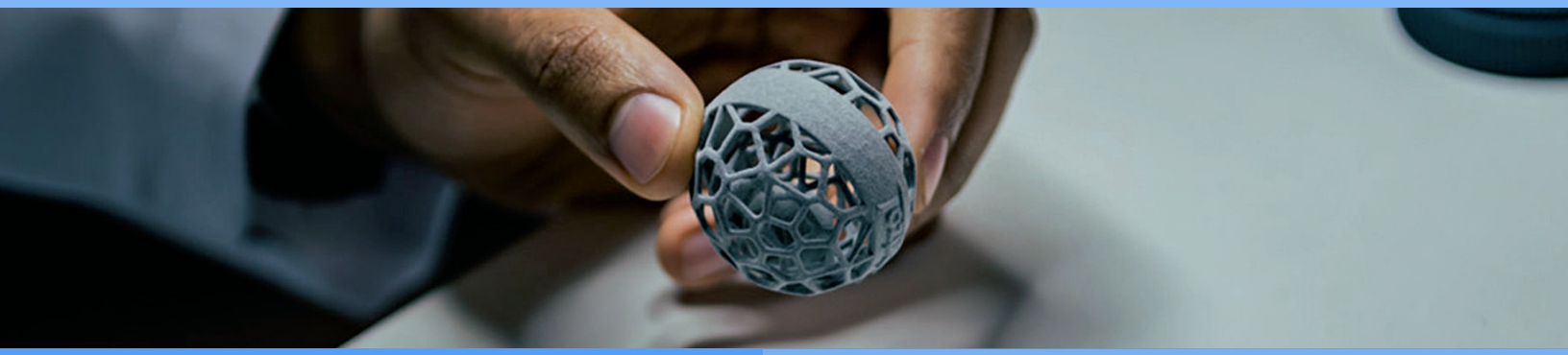
| Statements[10] | HP 3D High Reusability PA 11 | HP 3D High Reusability PA 12, enabled by Evonik | HP 3D High Reusability PA 12 S, enabled by Arkema | HP 3D High Reusability PA 12 W | HP 3D High Reusability PA 12 Glass Beads | HP 3D High Reusability PP, enabled by BASF[4] | HP 3D High Reusability TPA, enabled by Evonik |
|---|---|---|---|---|---|---|---|
| Bio-compatibility | ✔ | ✔ | testing | ✔ | n/a | ✔ | n/a |
| REACH | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| RoHS | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| PAHs | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Statement of composition for toy applications | ✔ | ✔ | n/a | | n/a | ✔ | n/a |
| UL 94 and UL 746A | ✔ | ✔ | testing | ✔ | ✔ | ✔ | n/a |

# HP 3D Materials Certification Program

The certification program provides an opportunity and pathway for third-party vendors to develop materials compatible with HP Jet Fusion 3D Printing solutions.

Joining the HP 3D Materials Certification Program enables material innovation partners to help expand 3D printing materials to address a broader set of applications—driving performance improvements and new possibilities for part properties that address specific industry needs—and making new applications possible.

Materials partners interested in engaging with HP are invited to complete the "Connect with us" form here: hp.com/go/3Dcontactus



# Materials certified for HP Jet Fusion 3D Printing

HP is committed to expanding our portfolio of materials certified for HP Jet Fusion 3D Printing solutions. We're working with a variety of other third-party vendors to increase the materials and application options available.

Certified for HP Jet Fusion 3D printers

Tested and approved solely for compatibility with HP Jet Fusion 3D printers[27]

## BASF Ultrasint® TPU01[4]: flexible, functional parts

Delivers highly flexible and durable part performance, ideal for serial production. Main application fields are consumer (shoes, protection), healthcare (O&P), automotive (interior & exterior), and industrial (jigs & fixtures).

- Skin contact compatibility[32]
- Hardness (Shore A): 88-90[33]
- Up to 80% powder reusability[34]

Data courtesy of HP - BASF

## ESTANE® 3D TPU M95A: high rebound and good abrasion resistance

An ideal fit for both prototyping and manufacturing scale-up applications, delivering high-energy rebound, high-impact absorption, a good abrasion resistance rate, and high elasticity, combined with excellent unpacking/de-powdering properties.

- Skin contact compatibility[35]
- Hardness (Shore A): 95[36]
- Up to 80% powder reusability[37]

Data courtesy of HP - Lubrizol

## ESTANE® 3D TPU M88A: flexible, durable, and lightweight parts

Easy to unpack, which means you can produce more complex lattice design structures while also improving operational and cost efficiencies. Dye and coat finished raw parts when colored parts or aesthetics are needed. They're highly durable, offering high abrasion and puncture resistance, low-temperature flexibility, high-temperature resistance, and outstanding chemical resistance.

- Skin contact compatibility[36]
- Hardness (Shore A): 88[38]
- Up to 80% powder reusability[39]


Data courtesy of HP - Lubrizol

# Active partnerships

We're working with the following industry-leading materials companies to better address 3D printing needs across industries. Together with our growing network of materials innovation partners, we're enabling performance improvements and new possibilities for part properties.

# Hands-on materials advancement

## Material Development Kit

Jumpstart the development process with the Material Development Kit (MDK)—developed by HP and SIGMADESIGN, the industry's first MDK helps materials suppliers more effectively—and successfully—develop their first powder materials for the HP Multi Jet Fusion platform. The MDK enables companies interested in certifying their materials to quickly test 3D powder spreadability and compatibility with HP Jet Fusion 3D Printers prior to submitting the materials to HP for testing.

## HP 3D Open Platform Materials and Applications Lab

HP 3D Open Platform Materials and Applications Lab—As part of our commitment to the evolution and widespread adoption of 3D printing, we're inviting materials companies to work in a collaborative lab environment. Located in Corvallis, Oregon, the HP 3D Open Platform Materials and Applications Lab is the world's first state-of-the-art lab helping companies develop, test, certify, and deliver the next generation of materials and applications for HP 3D Printing. This 3,500 square-feet facility offers 3D partners a range of equipment and in-house expertise to jumpstart and accelerate materials innovation and the development of new applications. This is critical to quickening the evolution and adoption of 3D printing technologies.

## Technical guidelines for material development

Access to comprehensive technical guidelines for suppliers who are interested in developing suitable materials for HP Multi Jet Fusion technology through the HP Open Materials platform. For more information, please visit: hp.com/go/guidelinematerialdevelopment

# HP 3D Printing materials portfolio selection guide[40]

| | HP 3D HR PA 12 W | HP 3D HR PA 11 | HP 3D HR PA 12 S, enabled by Arkema | HP 3D HR PA 12, enabled by Evonik | HP 3D HR PA 12 GB | HP 3D HR PP, enabled by BASF |
|---|---|---|---|---|---|---|
| | Rigid polymer | | | | | |
| Stiffness | ● | ● | ● | ● | ★ | ■ |
| Impact resistance | ■ | ● | ■ | ■ | ▲ | ■ |
| Elongation | ■ | ● | ▲ | ■ | ▲ | ■ |
| Dimensional capability | ★ | ● | ★ | ★ | ● | ■ |
| Level of detail | ★ | ★ | ★ | ● | ● | ■ |
| Flat part | ● | ■ | ● | ● | ★ | ▲ |
| Temperature resistance | ■ | ▲ | ■ | ■ | ● | ■ |
| Chemical resistance[9,25] | ● | ● | ● | ● | n/a | ★ |
| Low moisture absorption | ▲ | ▲ | ▲ | ▲ | ▲ | ★ |
| Lightweight | ● | ● | ● | ● | ■ | ★ |
| Surface roughness | ● | ● | ★ | ● | ● | ■ |

| | HP 3D HR TPA, enabled by Evonik | BASF Ultrasint® TPU01 | ESTANE® 3D TPU M95A | ESTANE® 3D TPU M88A |
|---|---|---|---|---|
| | Elastomeric polymer | | | |
| Rebound (%) | ★ | ● | ● | ● |
| Elongation-at-break (%) | ● | ● | ★ | ● |
| Tensile strength (MPa) | ● | ● | ★ | ● |
| Abrasion resistance (mm) | ● | ★ | ● | ● |
| Bio-compatibility | ▲ | ★ | ★ | ★ |

★ Best ● Good ■ Fair ▲ Not recommended

# Ordering information

| Material | | HP Jet Fusion 5600 Series 3D Printing Solution | HP Jet Fusion 5400 Series 3D Printing Solution | HP Jet Fusion 5200 Series 3D Printing Solution | HP Jet Fusion 4200 Series 3D Printing Solution | HP Jet Fusion 5000 3D Printer* |
|---|---|---|---|---|---|---|
| V1R18A | HP 3D High Reusability PA 11, 300 L (140 kg) | × | × | ✓ | ✓ | × |
| V1R36A | HP 3D High Reusability PA 11 production material, 300 L (140kg)[41] | × | × | ✓ | ✓ | × |
| V1R24A | HP 3D High Reusability PA 11, 1,700 L (750 kg)[42,43,44] | × | × | ✓ | ✓ | × |
| V1R10A | HP 3D High Reusability PA 12, enabled by Evonik, 30 L (13 kg) | ✓ | × | ✓ | ✓ | ✓ |
| V1R16A | HP 3D High Reusability PA 12, enabled by Evonik, 300 L (130 kg) | ✓ | × | ✓ | ✓ | ✓ |
| V1R34A | HP 3D High Reusability PA 12, enabled by Evonik, production material 300 L (130 kg)[41] | ✓ | × | ✓ | ✓ | ✓ |
| V1R20A | HP 3D High Reusability PA 12, enabled by Evonik, 1,400 L (600 kg)[c] | ✓ | × | ✓ | ✓ | ✓ |
| 910J7A** | HP 3D HR PA 12 S, enabled by Arkema, 300 L/170 kg material | × | × | ✓ | × | × |
| 9V508A** | HP 3D HR PA 12 S, enabled by Arkema, 1,220 L/500 kg material | × | × | ✓ | × | × |
| V1R22A | HP 3D High Reusability PA 12 Glass Beads, 300 L (150 kg) | × | × | ✓ | ✓ | × |
| V1R35A | HP 3D High Reusability PA 12 Glass Beads production material, 300 L (150 kg)[41] | × | × | ✓ | ✓ | × |
| V1R23A | HP 3D High Reusability PA 12 Glass Beads, 1,400 L (700 kg)[42,43,44] | × | × | ✓ | ✓ | × |
| 6M032A | HP 3D High Reusability PA 12 W production material, 300 L (130 kg) | × | ✓ | × | × | × |
| V1R28A | HP 3D High Reusability PP, enabled by BASF, 300 L (100 kg) material | × | × | ✓ | × | × |
| V1R37A | HP 3D High Reusability PP, enabled by BASF, 300 L (100 kg) production material[45] | × | × | ✓ | × | × |
| V1R38A | HP 3D High Reusability TPA, enabled by Evonik, 300 L (120 kg) material | × | × | × | ✓ | × |
| V1R39A | HP 3D High Reusability TPA, enabled by Evonik, 300 L (120 kg) production material[46] | × | × | × | ✓ | × |
| 300071 | BASF Ultrasint® TPU01, 300 L (150 kg) | × | × | ✓ | × | × |
| 300072 | BASF Ultrasint® TPU01, 1,000 L (500 kg)[47] | × | × | ✓ | × | × |
| 3DTW0300 | ESTANE® 3D TPU M95A, 300 L (160 kg) | × | × | × | ✓ | × |
| 3DTW0900 | ESTANE® 3D TPU M95A-545, 900 L (480 kg) | × | × | × | ✓ | × |
| 3DTW003B | ESTANE® 3D TPU M88A, 300 L (160 kg) | × | × | ✓ | × | × |

Note: Liters refers to the materials' container size and not the actual materials' volume. Materials are measured in kilograms.

*Available through HP 3DaaS

**Available in June 2024

Dynamic security-enabled printer. Only intended to be used with cartridges using an Original HP 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/learnaboutsupplies

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

1. 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.
2. Industry-leading surplus powder reusability, based on using HP 3D High Reusability PA 11 and PA 12 at recommended packing densities.
3. 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 material, and the powder reusability ratio recommended by manufacturer, and printing under certain build conditions and part geometries.
4. Available for HP Jet Fusion 5200 Series 3D Printing Solutions.
5. Based on internal HP testing, May 2020. HP Jet Fusion 3D Printing Solutions using HP 3D High Reusability PP, enabled by BASF, provide up to 90% powder reusability ratio, producing functional parts batch after batch. For testing, material is aged in real printing conditions and reclaimed powder is tracked by generations (worst case for reusability). Parts are then made from each subsequent generation and tested for mechanical properties and accuracy showing no degradation of properties up to three generations of use.
6. Available for HP Jet Fusion 4200 Series 3D Printing Solutions.
7. Based on published specifications as of September, 2020. HP Jet Fusion 3D Printing Solutions using HP 3D High Reusability TPA, enabled by Evonik, provide up to 17% lower printed part weight when compared to common powder-based thermoplastic elastomers printed under similar conditions.
8. 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.
9. For HP 3D High Reusability PA 11 and PA 12 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 BASF Ultrasint® TPU01, based on testing by BASF, April 2020, according to ASTM D471 for select IRM oils and Fuel A.
10. For more information, see hp.com/go/statementsPA11, hp.com/go/statementsPA12, hp.com/go/statementsPA12GB, hp.com/go/statementsPP, and hp.com/go/statementsTPAEVONIK.
11. 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.
12. 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.
13. Bio-based raw material certified by Arkema.
14. 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.
15. Carbon footprint reduction calculated by Arkema.
16. 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.
17. 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.
18. Carbon footprint reduction calculated by Evonik.
19. 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.
20. 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.
21. Compared to selective laser sintering (SLS) technology. Tested according to ASTM D638, ASTM D256, ASTM D790, and ASTM D648.
22. Testing according to ASTM D638, ASTM D256, and ASTM D648 with a 3D scanner for dimensional stability. Testing monitored using statistical process controls.
23. 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.
24. Compared to selective laser sintering (SLS) technology. Based on running a scan on the 3D Printing part to measure and compare with the original STL file (using GOM software). 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.
25. For HP 3D High Reusability PP enabled by BASF, based on internal HP testing, May 2020, with tests for mechanical property retention, dimensional stability, and weight change after 7- and 30-day immersion with acids, bases, organic solvents, and aqueous solutions. Due to the material characteristics, extra tuning is required in part design and printing, compared to other rigid HP 3D Printing materials.
26. Compared to other materials in the HP 3D materials portfolio as of May, 2020.
27. Based on internal HP testing, September 2020, compared to other HP 3D Printing materials compatible with the HP Jet Fusion 4200 3D Printing Solution. Testing variables: Part quantity: 1 full build chamber of parts from HP Jet Fusion 3D at 6.5% of packing density; Part size: 30 $cm^3$; Layer thickness: 0.08/0.003 - 0.1 mm/0.0039 inches.
28. HP Jet Fusion 3D Printing Solutions using HP 3D High Reusability TPA, 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.
29. HP Jet Fusion 3D Printing Solutions using HP 3D High Reusability PA 12 W provide up to 75% 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.
30. 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. Testing monitored using statistical process controls.
31. Compared to selective laser sintering (SLS) technology. Tested according to ASTM D638, ASTM D256, ASTM D790, and ASTM D648.
32. Testing according to ISO 10993-5, OECD Guideline no. 439, ISO 10993-10 and OECD Guideline no. 429.
33. Testing according to DIN ISO 7619-1.
34. Reusability ratio recommended by BASF.
35. Testing according to ISO 10993-5 and 10993-10.
36. Technical datasheet available upon request.
37. Reusability ratio recommended by Lubrizol.
38. Testing according to ASTM D-2240.
39. Standard refresh rate suggested by Lubrizol, as the powder blend is reclaimed for more printing cycles, the yellowness of the powder blend increases.
40. Based on internal HP testing, October 2022. For testing methodology and results, see hp.com/go/3Dprintingmaterialswhitepapers. Please consult your local sales representative for more information.
41. Only compatible with the HP Jet Fusion 5210 Pro/5210/4210/4210B 3D Printing Solutions.
42. Additional material management equipment is required.
43. Only compatible with the HP Jet Fusion 5210 Pro/4210B 3D Printing Solutions.
44. This product number is sold directly by HP.
45. Only compatible with the HP Jet Fusion 5210 Pro/5210 3D Printing Solutions.
46. Only compatible with the HP Jet Fusion 4210B 3D Printing Solution.
47. Only compatible with the HP Jet Fusion 5210 Pro 3D Printing Solution.
48. Cost analysis based on standard solution configuration price, supplies price, and maintenance costs recommended by HP, comparing HP 3D HR PA12, enabled by Evonik and HP 3D HR PA12 S, enabled by Arkema (both using Balanced print mode) and power reusability recommended by HP. Cost criteria: printing 5 full builds per week, 220 working days per year, 36 cc part volume, 7% packing density, and 80 parts per build.
49. HP Jet Fusion 3D Printing Solutions using HP 3D High Reusability PA 12 S, enabled by Arkema, provide up to 85% 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.
50. Based on internal HP testing for Linear Surface roughness (Ra). HP tested 5 copies using HP 3D HR PA12, enabled by Evonik, and HP 3D HR PA12 S, enabled by Arkema (both using Balanced print mode), with the HP Jet Fusion 5200 series 3D Printing Solution and post-processed with sandblasting. Tested all 5 faces of the printed part.
51. Based on internal HP testing, you can achieve zero waste by applying all the fresh materials added to the system to the final printed parts (starting at 85% reusability ratio and 7% packing density). With HP 3D HR PA 12 S, enabled by Arkema, using Balanced print mode, printed part density doubles powder density, optimizing powder usage for continuous printing (requiring a fresh material ratio that's twice the input packing density).
52. Recycling program from Arkema. Available in Europe and US. Check Arkema's website for more information.



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