The future of automotive additive manufacturing

Increase your ROI with SAF, FDM and P3 technologies from Stratasys

stratasys

The Shift from Traditional to Additive Manufacturing

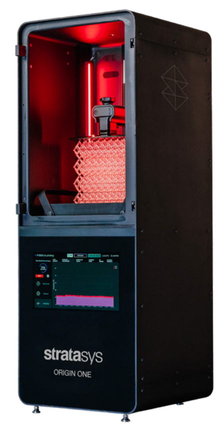
As the automotive industry continues to expand, it is increasingly turning toward additive manufacturing (AM) for production-grade parts. In contrast to traditional manufacturing, additive manufacturing can create these parts within a shorter lead time while preserving complexities and cost efficiency. 3D printing allows production to be expedited significantly. It not only reduces organizations' reliance on slower traditional manufacturing techniques, but also enables manufacturers to produce end-use parts in their own factories. This reduces shipping needs and stabilizes the supply chain. Moving towards additive manufacturing allows for an increase in customization options. This will be essential in addressing fleet management and consumer demands for the latest advancements in hardware technology and software.

Material Capabilities

SAF™ technology utilizes High Yield PA11 polymer powder which creates production-grade parts that have high mechanical durability, accurate geometric properties and strong impact resistance. PA11 is sustainable and eco-friendly since it is completely derived from bio-based castor oil. PA11 supports a high nesting density while maintaining part consistency to achieve production level yields. These end-use parts are lighter than their traditional manufacturing counterparts, resulting in greater efficiency. Automotive parts created with PA11 lead to increased areas of business growth and opportunities for manufacturers.

FDM® and P3™ AM technologies encompass a wide range of polymer materials, allowing greater freedom to match the material with the application. Thermoplastics can also replace metal under the right circumstances, meaning tools and parts can be lighter and more efficient. Open materials and industry partnerships with material suppliers allow this diverse ecosystem to continually expand, resulting in new materials that transform AM's application space.

Programmable PhotoPolymerization (P3) is an evolution of DLP printing capabilities that include several tightly controlled, programmable steps that support production applications with photopolymers, and has much lower separation forces than traditional DLP. P3 has an expansive and growing material catalog, including options that are elastomeric, high-heat, FST-rated, tough, durable and economical.



SAF Technology

The H350™ powered by SAF technology produces consistent automotive parts which are accurate, cost-efficient and demonstrate strong mechanical capabilities. This is due to SAF technology's in-line unidirectional architecture and equal distribution of thermal energy during the printing process. The H350 supports a high build capacity of up to 12%*, optimizing series production of end-use parts.

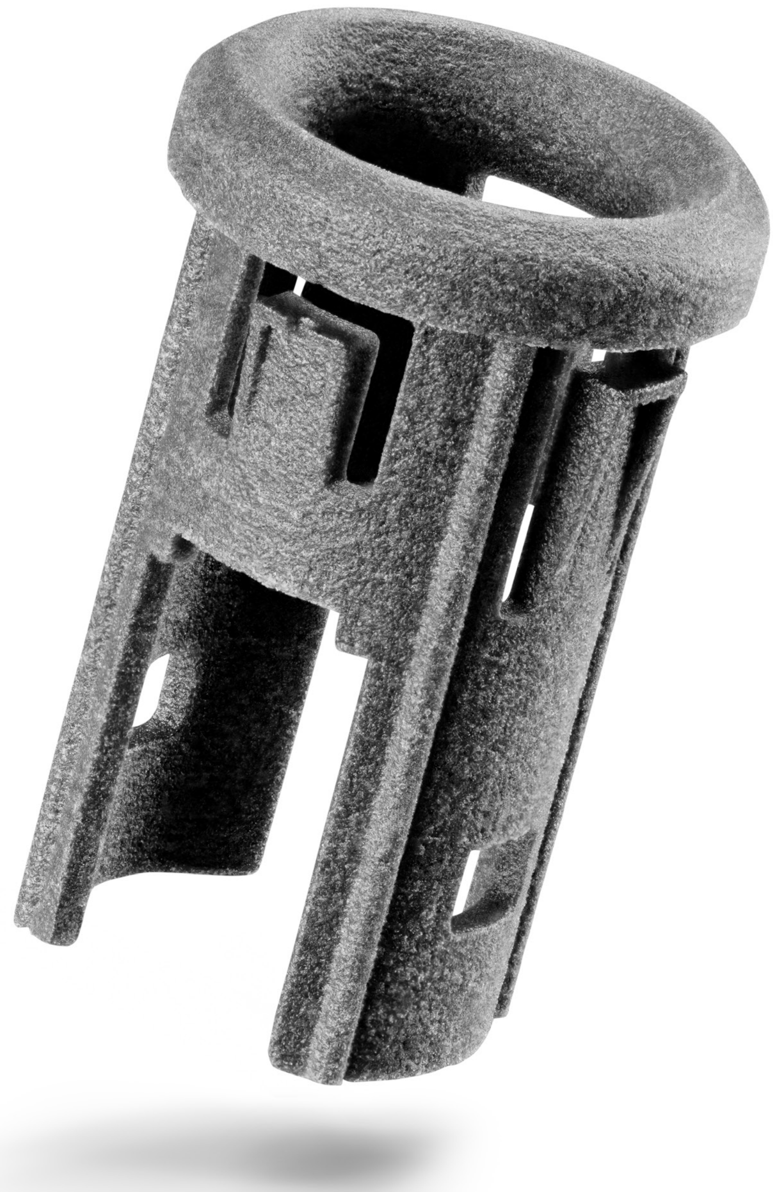
FDM Technology

FDM technology offers a versatile, easy-to-use 3D printing platform with multiple printer types and a broad range of thermoplastic materials. FDM printers accommodate small to substantial parts, making them suitable for numerous automotive 3D printing applications, including prototyping, tooling and production parts. GrabCAD Print™ software simplifies print-to-part workflow, and integral technology protects sensitive data security.

P3 Technology

The Origin® One printer uses P3 technology and has ushered in a new era of 3D printing: mass production of functional end-use parts. P3 software precisely orchestrates light, temperature, pull forces and pneumatics to optimize prints for the best possible results. Achieve injection molding part quality and surface finish with incredible accuracy, in a diverse and continuously growing range of high-performance materials.

* Please note that 12% nesting density is a typical standard and depends on the part's geometry. Geometries may achieve 12% nesting density, some can't reach 12%, while others can surpass 12%.



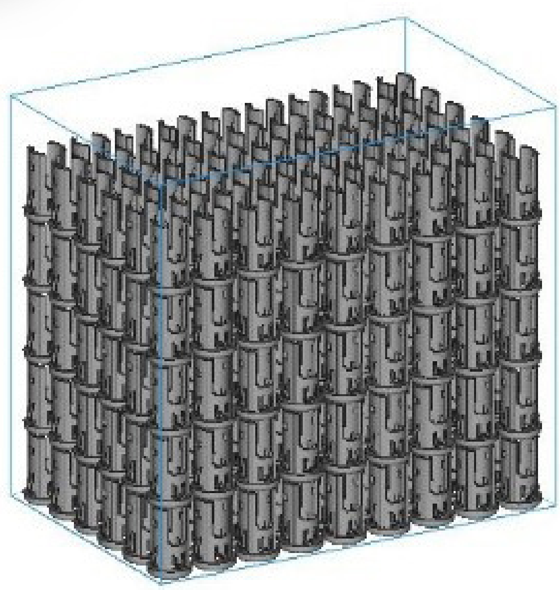
SAF Technology:
Parking Sensor Housing

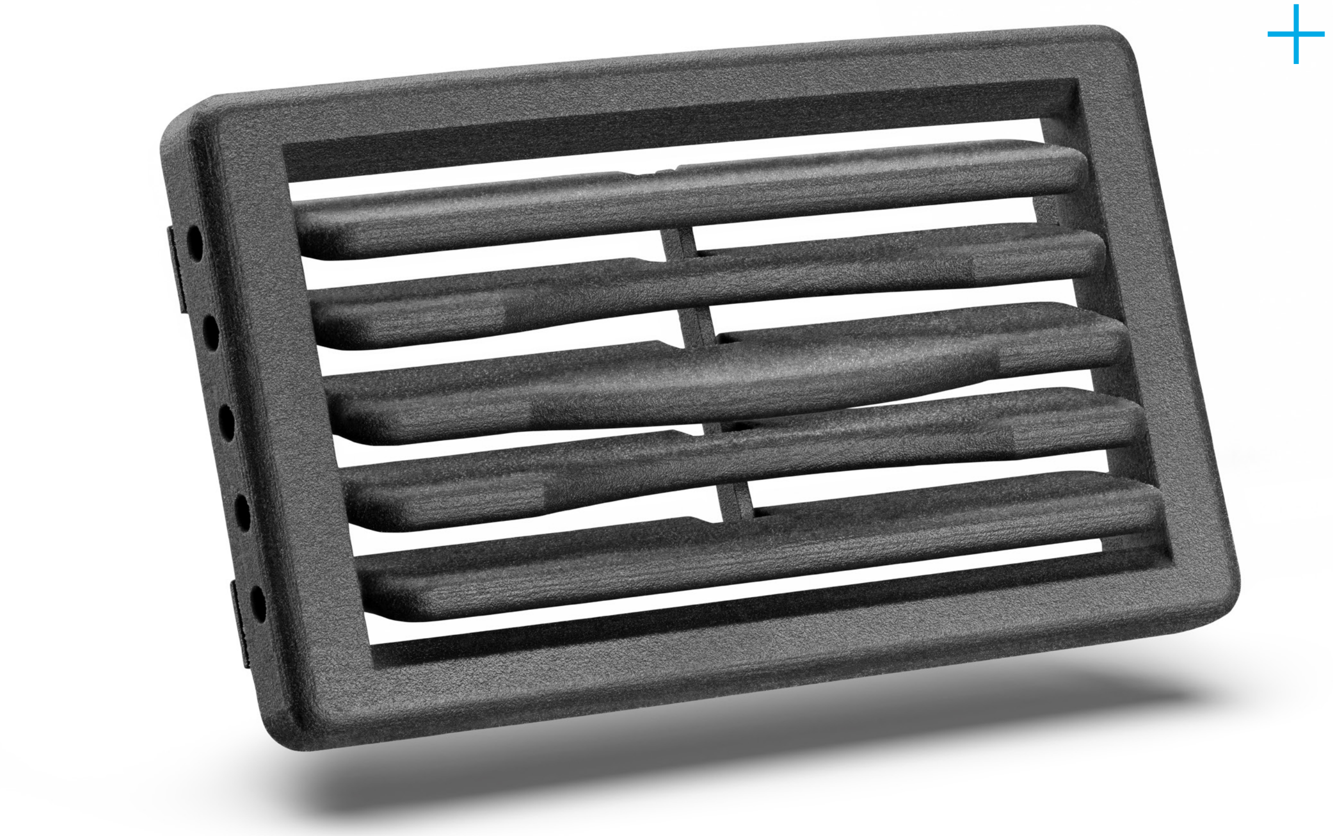
The parking sensor housing is mounted within the bumper on the exterior of a vehicle. The part is small and nests well inside the build volume of the machine. This part could be manufactured at a high volume without the need for tooling, allowing spare parts to be produced on demand. Designers are also free to iterate as required between models.

Printed Layer Time: 8 hrs 30 mins for 270 pieces

Material: PA11 polymer powder

Volume of Material Used: 6.99 cm^3 (0.43 in^3)





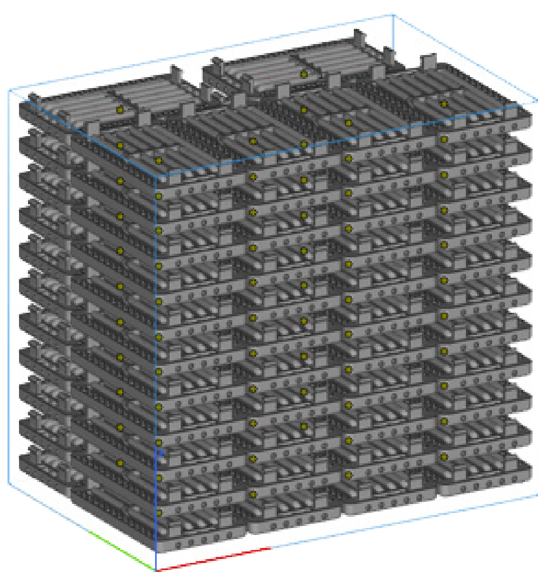
SAF Technology:
Air Vent

The HVAC air vent is commonly found within a vehicle's interior. The vent is composed of a 7-piece moving assembly printed in place in the H350. This removes the need for any post build assembly of components. Due to SAF technology's consistency, each vent is geometrically accurate. The part may be finished by smoothing, spraying or dyeing. It can also be left natural.

Printed Layer Time: 9 hrs 40 mins for 66 HVAC air vent grills

Material: PA11 polymer powder

Volume of Material Used: 73.5 cm^3 (4.5 in^3)



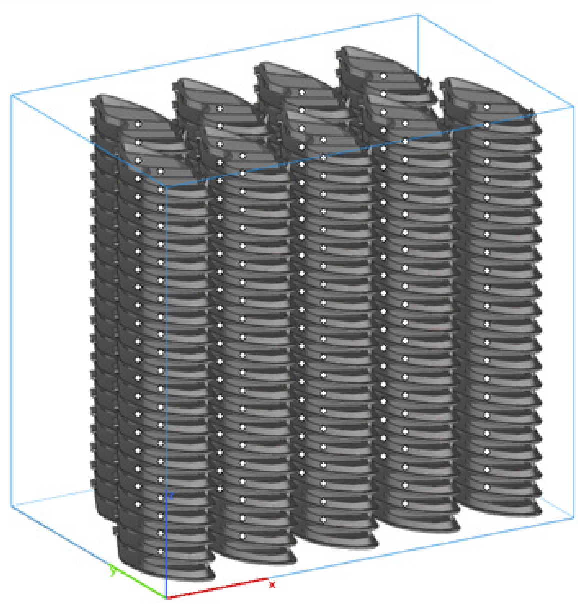
SAF Technology:
Automotive Vent

This vent is typical of parts found within a vehicle's interior. The part must be impact resistant with a smooth surface finish. This can be achieved with High Yield PA11 polymer powder which provides ductility and high mechanical durability. The part may be finished by smoothing, spraying, dyeing or left natural.

Printed Layer Time: 9 hrs 30 mins for 198 automotive vents

Material: PA11 polymer powder

Volume of Material Used: 12.99 cm^3 (0.79 in^3)



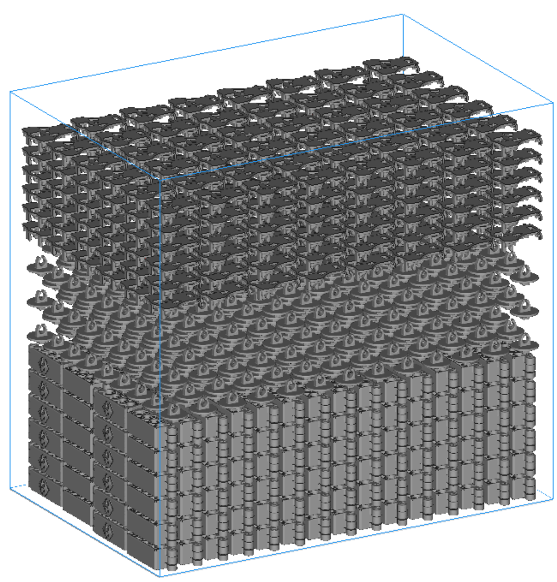
SAF Technology:
Electrical Cable Clips

This is an example of a clip used to secure electrical cables within a mechanical system. This part demonstrates the capability of SAF technology to create end-use production parts at at scale. These parts are small, and a large number can be nested in a single build. The repeatability of the machine throughout its build volume ensures that there will be a high yield of acceptable parts. This eliminates long lead times and high costs associated with injection molding design and manufacture.

Printed Layer Time: 9 hrs for 1,323 total clips

Material: PA11 polymer powder

Volume of Material Used: 3,270 cm^3 (199.55 in^3)



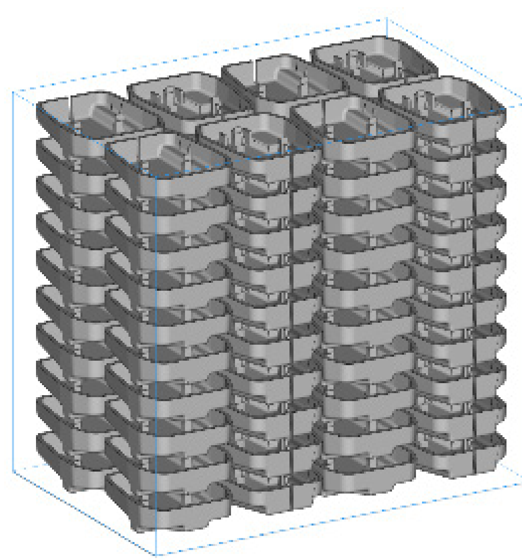
SAF Technology:
Rain Sensor Cover

The rain sensor cover is visible so the exterior face must have a smooth and even finish. This is easily achieved with SAF since large, flat areas are supported. Inside the part, there are clips and location pins to locate and mount it correctly into position. These clips and pins must be built accurately and repeatably, so they fit correctly each time.

Printed Layer Time: 13 hrs and 30 mins for 80 rain sensor covers

Material: PA11 polymer powder

Volume of Material Used: 2,778 cm^3 (169.52 in^3)



FDM Technology:
Prototype Gearbox Housing

Offering high mechanical strength, production-grade quality and UV stability, ASA material printed on the F123™ series printers is well suited for form and fit testing of automotive prototypes.

Print time: 36 hrs

Material: ASA | Ivory

Model material used: 688 cm^3 (42 in^3)

Support material used: 279 cm^3 (17 in^3)

FDM Technology:
Prototype Auto Fender

FDM technology is well suited for large prototypes and production parts like this fender, printed on the large-format F770™ printer. The F770 provides manufacturers with the capacity to make large prototypes and mock-ups while maintaining accurate dimensions for fit checks with mating parts.

Print time: 77 hrs and 15 mins

Material: ABS-M30™ | Black

Model material used: 2,343 cm^3 (143 in^3)

Support material used: 606 cm^3 (37 in^3)

FDM Technology:
Race Car Hood Vent

This large, one-piece hood vent prototype demonstrates the large print capacity of the F770 printer. It also highlights the printer's capability to build complex designs that include thin walls and intricate features while maintaining flatness and dimensional accuracy.

Print time: 128 hrs

Material: ABS-M30 | Black

Model material used: 1,163 cm^3 (71 in^3)

Support material used: 2,638 cm^3 (161 in^3)

FDM Technology:
Dashboard Panel

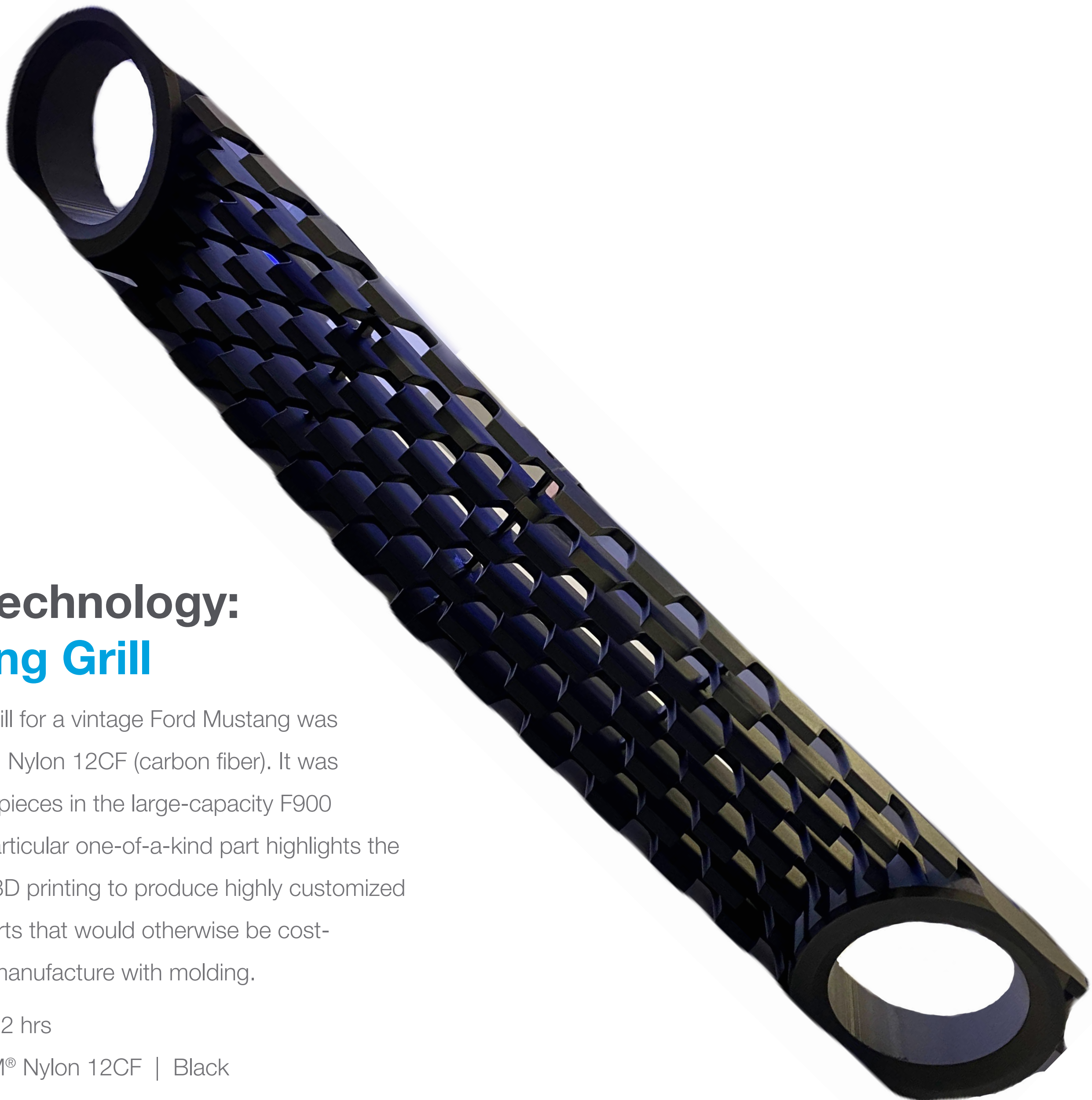
This final production part for a Radford Lotus Type 62-2 forms the substrate of the dashboard that is later covered with leather. The part is printed in one piece on an F900™ printer using gray ASA thermoplastic material. The F900 has the largest print capacity of all FDM printers.

Print time: 63 hrs and 30 mins

Material: ASA | Dark Gray

Model material used: 950 cm^3 (58 in^3)

Support material used: 2,655 cm^3 (162 in^3)



FDM Technology: Mustang Grill

The custom grill for a vintage Ford Mustang was printed in FDM Nylon 12CF (carbon fiber). It was printed in two pieces in the large-capacity F900 printer. This particular one-of-a-kind part highlights the advantage of 3D printing to produce highly customized automotive parts that would otherwise be cost-prohibitive to manufacture with molding.

Print time: 122 hrs

Material: FDM® Nylon 12CF | Black

Model material used: 2,819 cm^3 (172 in^3)

Support material used: 2,294 cm^3 (140 in^3)

P3 Technology:
Electrical Connector Inserts

These connector and adapter parts showcase P3's ability to build parts that are comparable in both surface finish and mechanical properties as injection molded alternatives, ensuring a consistent fit. These parts were printed together in LOCTITE 3D 3955 HDT280 FST, a highly viscous material that is halogen-free, flame retardant, has high modulus and can withstand temperatures up to 300 °C. The Origin One has consistent repeatability with minimal supports needed, yielding exceptional parts in record time, with less material waste.

Note that the material, LOCTITE 3D 3955 HDT280 FST, has a high cost per kilogram compared to the general-purpose materials. This is the first photopolymer offered that passes UL94 V-0 flammability requirements and FST (AITM2-0002, AITM2-0007, AITM3-0005) and its high HDT allows it to withstand harsh environments with negligible deformation. These parts were able to be printed in less than two hours as a group. This was accomplished with a total volume of 116 mL without the use of supports.

6 pin adapter sample part:

Print time: 1 hr

Parts per print: 16

Material: LOCTITE 3D 3955 HDT280 FST

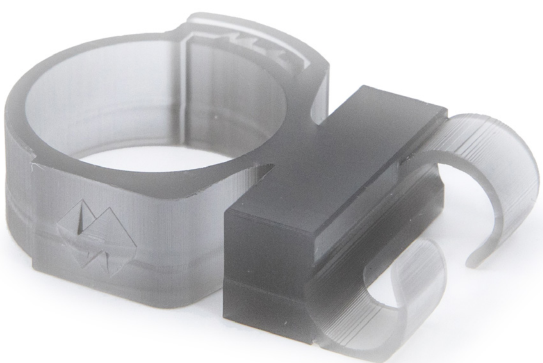
Volume per part: 4.93cc

P3 Technology: Cable Management

This type of part is an ideal application for the Origin One, as it is an industry leader for printing challenging overhangs and small features while maintaining excellent surface finish. The P3 catalog of materials offers multiple options for OEMs to choose from for each part, including high elongation at break, good impact strength and strong dielectric properties.

These small pieces can be printed in sets of six to ten in less than two hours, allowing for rapid iterations and production on demand. Small details such as logos can be added and showcase the Origin One's ability to print fine features reliably and with extremely high accuracy, as well as its ability to print overhangs up to 2mm. These cable management solutions were printed in a variety of materials:

- LOCTITE 3D 3172 HDT50 High Impact Clear
- LOCTITE 3D 3172 HDT50 High Impact Black
- LOCTITE® 3D 3843 High Toughness by Henkel
- SOMOS® QuickGen 500
- Ultracur3D® ST45 by BASF



Ring clip sample part:

Print time: 57 mins

Parts per print: 10

Material: LOCTITE 3D 3172 HDT50 High Impact Clear

Volume per part: 6.6cc

P3 Technology:
Elastomer Seals

The Origin One is especially well suited for 3D printing elastomers, as it has advanced capabilities for printing flexible materials in challenging geometries while maintaining outstanding surface finish. These rubber seals were printed in Loctite 3D IND402, which is a single component elastomer with high resilience and rebound. This material has excellent tensile strength and does not require thermal post-processing and is comparable to TPUs with a Shore A hardness of 75.

Print time: 12 hrs and 42 mins for 12 parts

Per part print: 1 hr and 3 mins

Material: Loctite Loctite 3D IND402

Volume per part: 41.20cc


B/08

Delivering accurate results for automotive applications.
Build after build.

Visit Stratasys.com for more information about FDM, P3 and SAF technology.