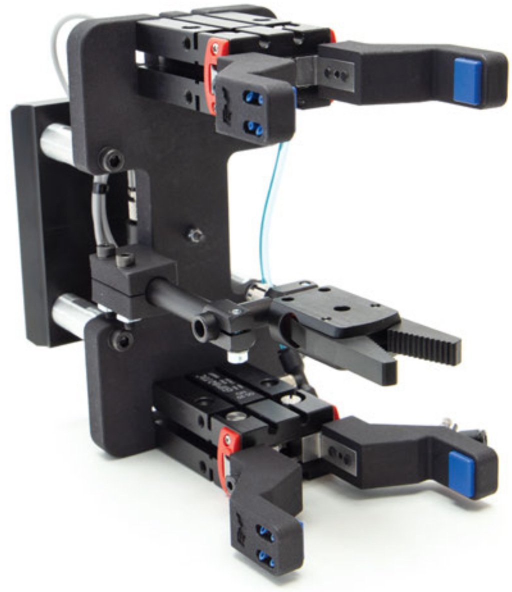
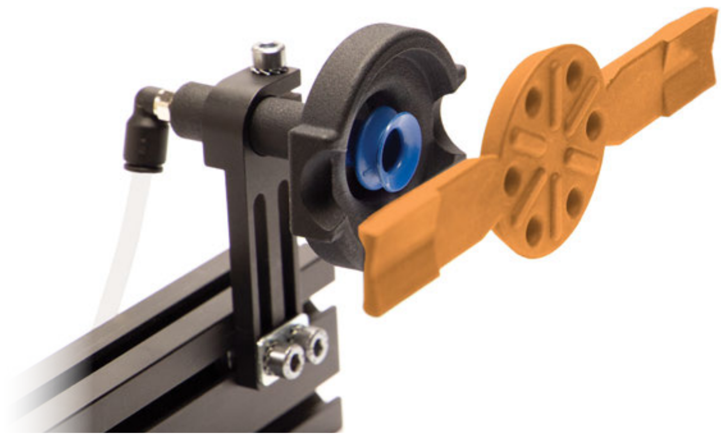
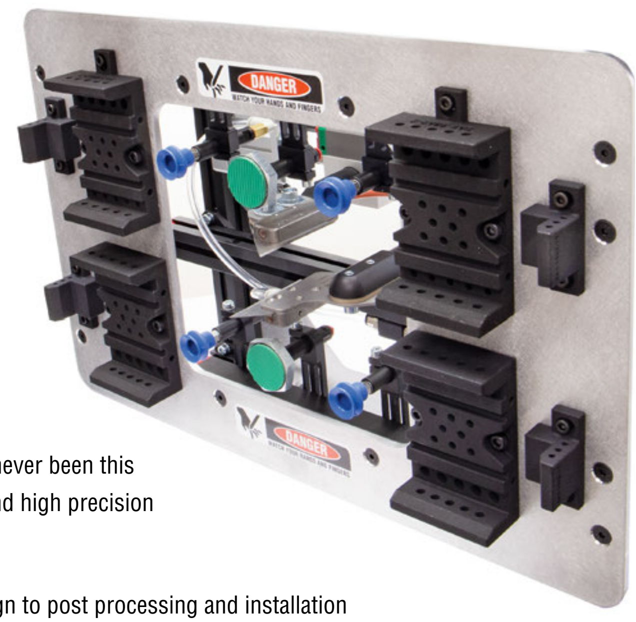
Additive Manufacturing by EMI



Since 2013, EMI's engineers have been utilizing Additive Manufacturing (AM) in robotic handling applications for the automotive, medical, consumer goods and plastic injection molding industry.

As an industry leader in robotic End of Arm Tooling (EOAT), we have found new, innovative ways to approach the traditional EOAT application. From custom nests to advanced hybrid gripper fingers, EMI is continually pushing the limits of 3D printing to support automation in the plastic injection molding industry.





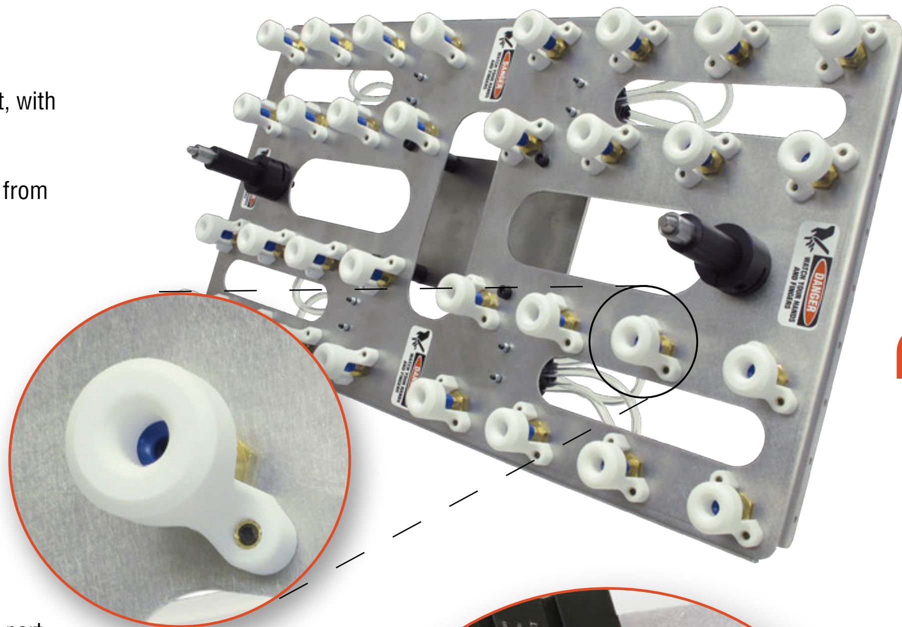
Part Nests create a negative of your molded part to nest and support it has never been this feasible. Isotropic properties allow 3D printed components to act as support and high precision elements in light and heavy duty EOAT applications.

Our EOAT Engineers understand the additive manufacturing process from design to post processing and installation because it is done in-house with quality checks in every step of the way. We have found ways to take additive manufacturing to the next level with complex designs that are used in real world, industrial applications. Find out more about our 3DV for Cobots on page 132.

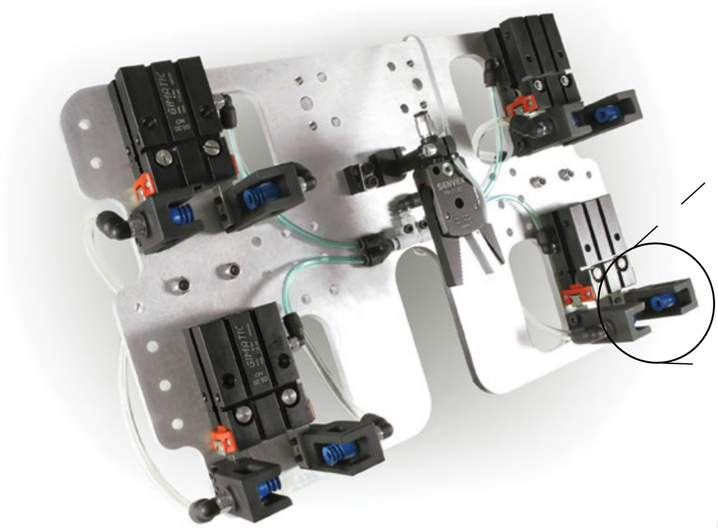
Typical EOAT Applications

Vacuum nests are an ideal application for 3D printing. Detect, secure and align your molded part, with simple or complex geometries.

Materials for clean room applications are available from EMI. Talk to our EOAT experts!



Vacuum fingers are a great way to handle your part and detect it without the use of sensors. Talk to our engineers to see if this is right for your application!

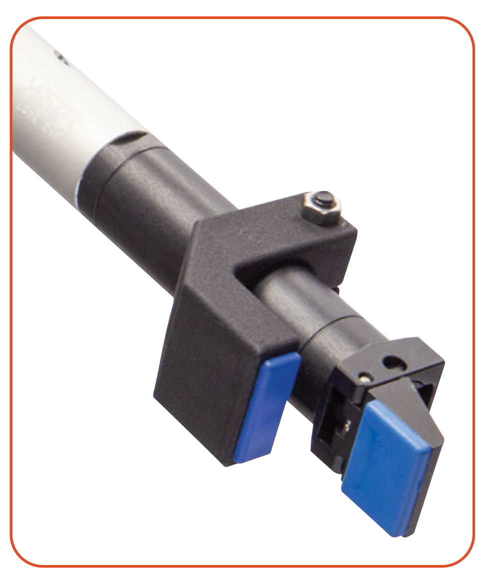


Hybrid EOAT is rapidly becoming a go-to option for customers who require lightweight and durable framing, but cannot afford to sacrifice precision and lead times. 3D printing for EOAT is an affordable, fast and a solid alternative. EMI EOAT Engineering is here to help with your application.

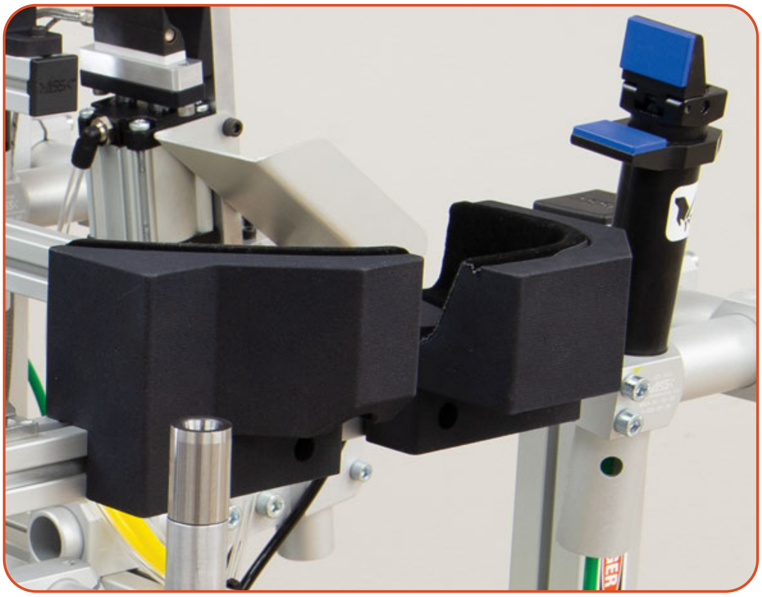
3D Printed Finger Examples

Gripper fingers that would normally be machined out of aluminum can be confidently designed and 3D printed for most applications. Thermal properties vary by material and soft-touch HNBR pads can be added. Take advantage of EMI's experience and talk with an EMI engineer about custom designed and printed gripper fingers for your application. We think you'll find EMI's 3D printing is affordable and fast.

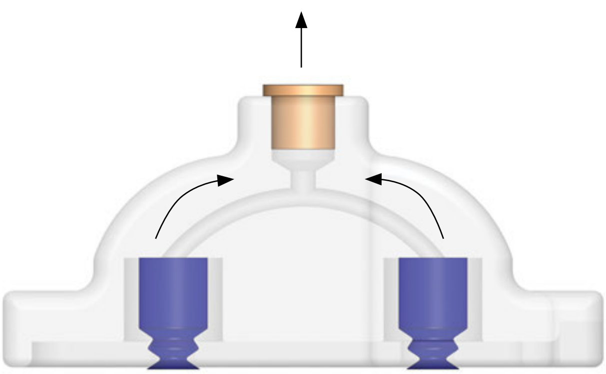
3D Printed Guides and Backstops are used to support the handling capabilities of Gripper Fingers. Accurately reaching behind a part is achievable with Gripper Fingers, and adding a 3D printed stop offers an even more secure grip. Gripper Fingers with 3D printed stops are a great alternative to handle parts that cannot be gripped with parallel grippers or vacuum cups. See "Gripper Finger Accessories" on page 526.



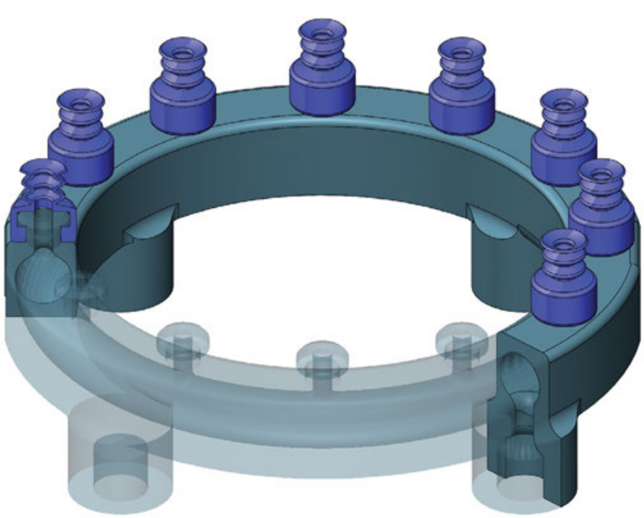
3D Printed Application Examples



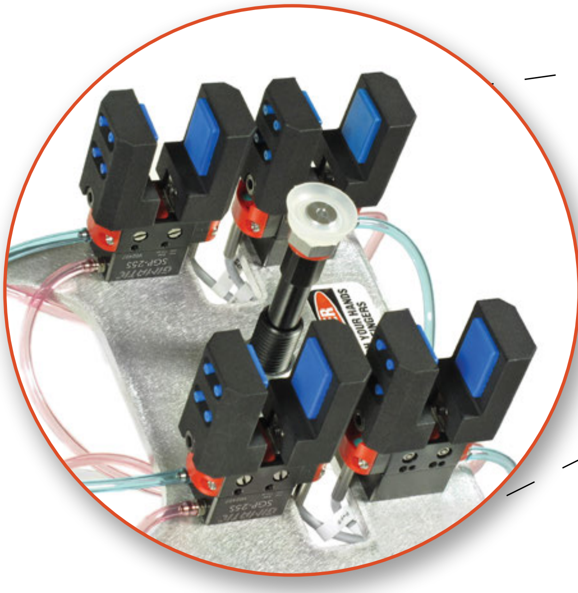
3D Printing for Degating In-house 3D Printing allows us to rapidly create custom and cost-effective nests for parts to ensure precise degating. Flocked part nests are used here for a soft-touch interface.

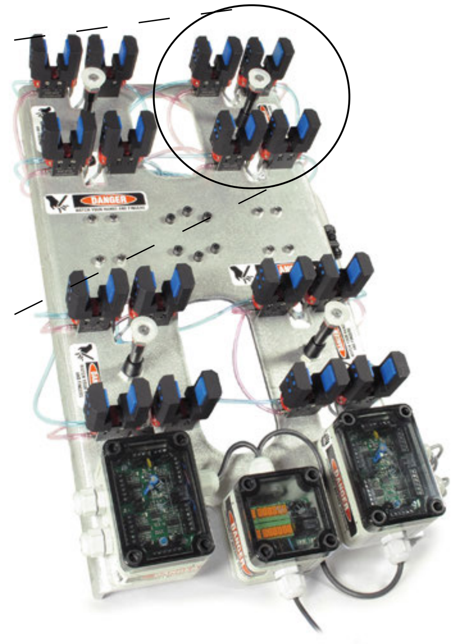


Create complex internal porting that would otherwise be very costly to machine!



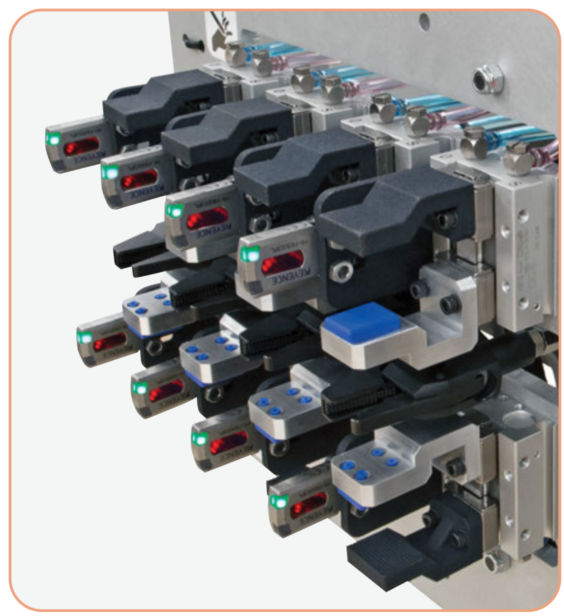
3D Printed Application Examples

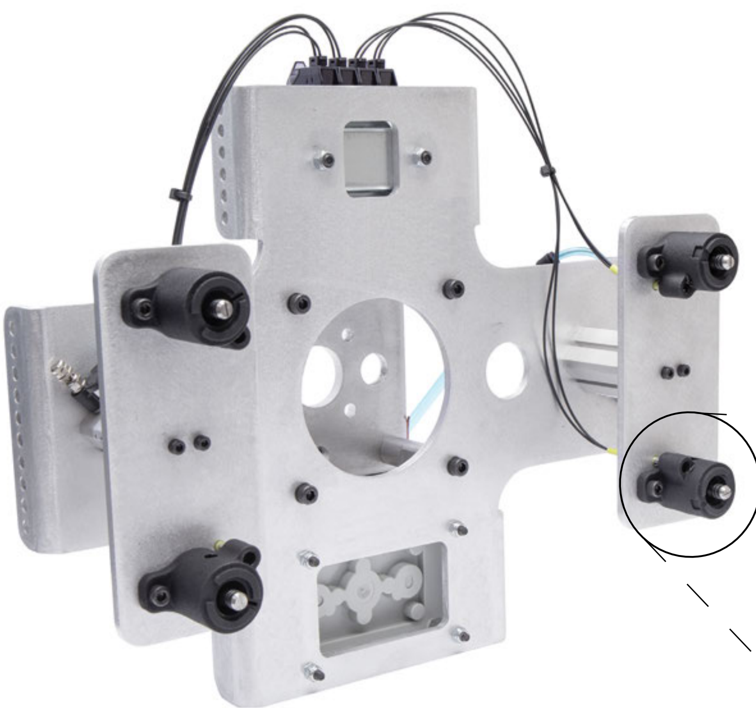


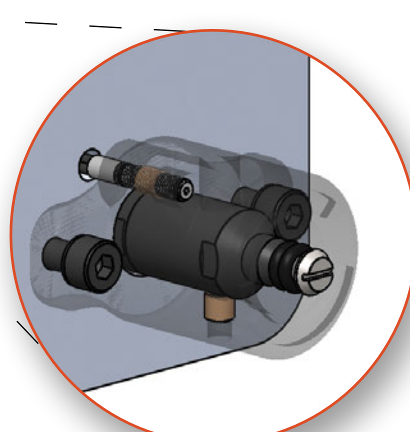


Simplify tools with creative custom components

Parallel grippers are one of the most common ways to grip molded plastic parts. Using custom padded fingers on a high precision SGP grippers from Gimatic is a great way to secure and detect your part without marring it and minimizing scrap. Find our popular SGP-S grippers on page 654, and low-profile MHF2 grippers on page 668.







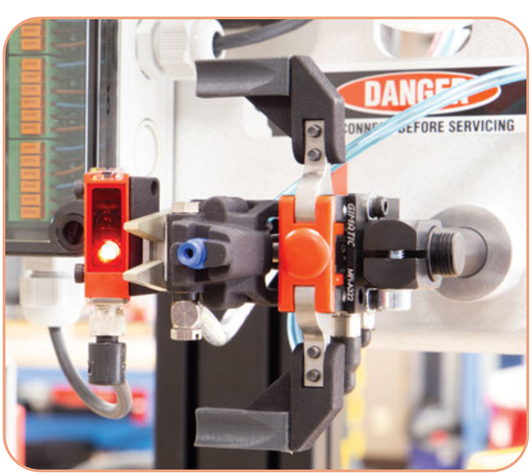
This plate-style tooling incorporates fiber optic sensing with an expansion gripper for ID part handling inside of a 3D printed nest. All available from EMI with the help of our EOAT team. Find Fiber-Optic Sensors on page 966.

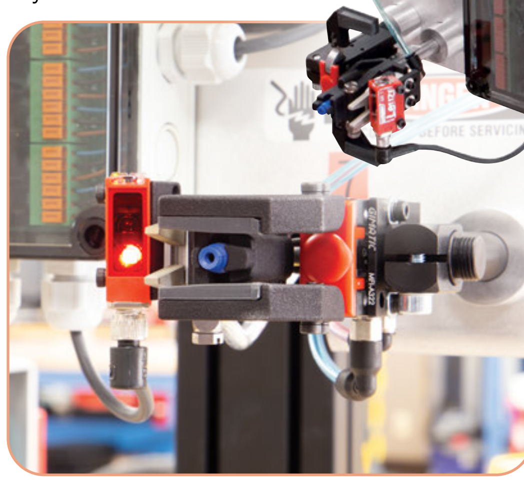
3D Printed Application Examples

Lightweight carbon fiber profile with 3D printed clamp and gripper finger guides.

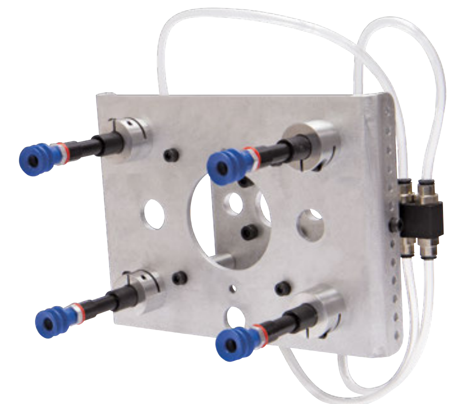
Different 3D printing methods can be combined to achieve a level of customization that only EMI can offer. Utilize the AM process and materials to save weight without sacrificing strength. SLA printing (shown below) forms a durable high-temp material used for finger pads in a variety of EOAT applications.

In the application below, 3D printed nests mounted on suspensions align the part with vacuum for part detection. Once detected, radial grippers secure the parts while the robot traverses to drop them on a conveyor.





Comparing EOAT Structures



	Profile-Based EOAT	3D-Printed EOAT	Plate-Style EOAT
Lead Time	Fastest	Fast	Varies by application
Weight	✓✓✓	✓	✓✓
Adjustability	✓✓✓	✓	✓
Common Applications			
High Number Of Cavities	✓✓✓	✓✓✓✓	✓✓✓✓✓
Small Parts	✓✓	✓✓✓✓✓	✓✓✓✓
Large Parts	✓✓✓✓✓	✓✓	✓✓✓
Insert Loading	✓✓	✓✓✓	✓✓✓✓✓
High-Speed Molding	✓✓✓	✓✓✓✓✓	✓✓✓✓
Degating	✓✓✓	✓	✓✓✓✓
EOATs with Nesting Features	✓✓✓	✓✓✓✓✓	✓✓✓✓

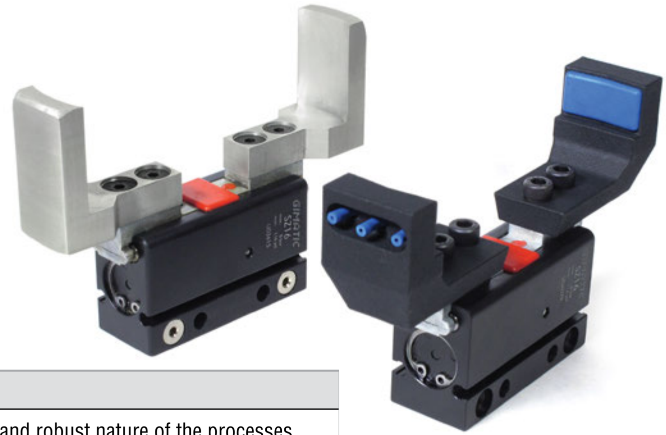
To help you decide which approach is best for your applications, this comparison explains the benefits of EMI's EOAT solutions as used by our Engineers on a daily basis.

EMI's 3DV Gripper Kit for Cobots is the perfect example of applications for 3D printed EOAT. Internal porting, built-in clamps and pressed inserts help keep it a lightweight, low-cost solution.

Profile Based EOAT are a proven solution for industrial applications. As you start to expand, weight adds up but the adjustability only increases. EMI has all the needed components in-stock to build adjustable EOAT that can also include 3D printed components for a more custom approach to your application.

Plate Style EOAT offer the highest precision, with reasonable weight requirements, where in some instances, adjustability can be offered for the less critical features of the application. 3D printed components are a perfect addition to plate tools. Custom laser cut or machined plates do require some manufacturing time, and EMI can help with that as well.

Additive Manufacturing by EMI



Machined vs. Additive Manufacturing

All manufacturing methods have their own benefits and drawbacks. Additive manufacturing methods have some benefits that traditional machining methods do not.

	3D Printing	Machining	
Lead Times	✓		Due to the fast and robust nature of the processes lead times are better for 3D printing
Precision	✓	✓+	While 3D Printing can be precise, machining can hold tighter tolerances
Complexity	✓		3D printing has less manufacturing constraints so it can produce more complex parts
Strength		✓	Machined metal is stiffer and stronger than plastic
Thermal Limit		✓	Metal can handle higher temperatures
Weight	✓		Complex internal lattice structure can be utilized in printing to lighten parts
Material Waste	✓		Very efficient process allows for very little scrap
Cost Effectiveness	✓		In general 3D printed parts cost less than machined parts

*Comparison can differ depending on materials and processes

EMI offers four methods of 3D Printing for EOAT application components:

	MJF	SLA	FFF	SLS
Description	Powder-Based PA-12 (Nylon) is our main method due to its isotropic and mechanical properties.	Provides exceptional detail and a wide variety of materials that can be used in many EOAT applications.	Nylon based filament with optional fiber inlay reinforcement.	Contact our Engineering Department to discuss your Clean Room EOAT project.
Cost	$	$ $	$ $	$ $ $
Lead Time	⌛	⌛ ⌛	⌛ ⌛ ⌛	⌛ ⌛ ⌛ ⌛
Production Quantity	Large	Small-Medium	Small	Large
Layer Thickness	70–100 microns	25–100 microns	100–200 microns	120 microns
Tensile Strength	🔧 🔧 🔧	🔧 🔧 *	🔧 🔧 *	🔧 🔧 🔧
Heat Deflection Temp.	🌡 🌡 🌡	🌡 *	🌡 🌡	🌡 🌡
Temperature Resistance^	🔥 🔥	🔥 🔥 🔥	🔥	🔥 🔥
Flexibility	Minimal	Varies per Material	None	Minimal
Impact Resistance	🔨 🔨	🔨 *	🔨	🔨 🔨
Surface Finish	Fairly Smooth	Smooth	Rough	Fairly Smooth
Ability to Seal Vacuum	Yes	Yes	No	Yes

* Multiple materials available, performance may vary based on selection.
^ Based on short-term 60 second temperature exposure.