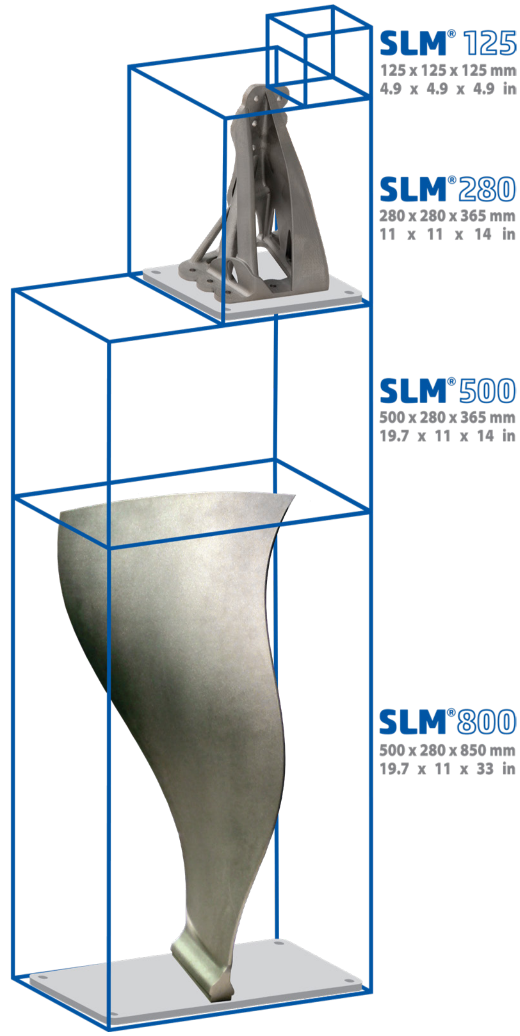
SLM SOLUTIONS

Can Your Part be Additively Manufactured? The Top 6 Things You Need to Know

As metal additive manufacturing continues to expand as a viable production process, many companies are assessing the possibility of producing parts with Selective Laser Melting. But while the concept of 3D printing is easy, (just push print!), additive manufacturing of repeatable quality parts can be complicated with lots to consider that may not be relevant to traditional manufacturing processes. Put together by our application engineering team, this guide will review what types of parts, features and geometries are best suited to be optimized for additive manufacturing.

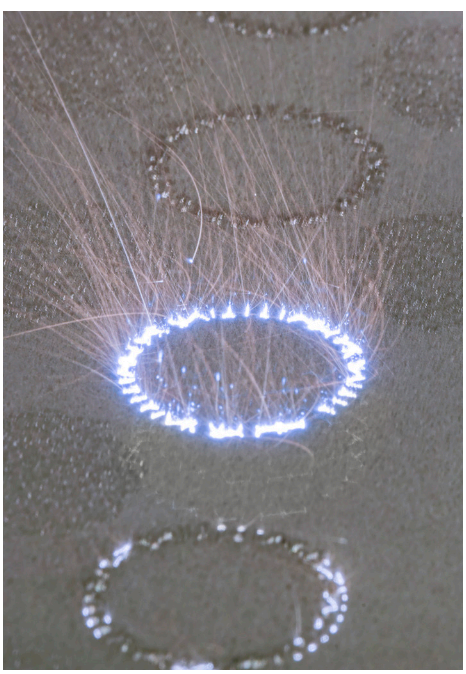


1. Does Your Part Fit?

This may seem like a simple and obvious point, but in metal additive manufacturing you're limited to your build envelope, so you must make sure your part can be built within the chamber parameters. Fortunately, machines come in a variety of sizes, so depending on what you're looking to accomplish, most likely there will be an option for you. Selective laser melting machines feature build volumes in the following sizes:

- 125 x 125 x 125mm / 4.9 x 4.9 x 4.9 in
- 280 x 280 x 365mm / 11 x 11 x 14 in
- 500 x 280 x 365mm / 19.7 x 11 x 14 in
- 500 x 280 x 850mm / 19.7 x 11 x 33 in

2. Is Your Material Weldable?



The powder bed fusion process uses powdered metal material, evenly distributed in thin, 20-90 micron layers across the build plate. A high-powered, fiber laser melts each layer into the previous layer in what is essentially a micro-welding process. By the end of the build, there are thousands of micro-welds on top of each other creating 99.9% dense metal material. Thus, it is essential that the material of your component be weldable, or your process to be flexible to allow use of an existing additive material that matches performance requirements, switching 7075 aluminum for AlSi10Mg, for example.

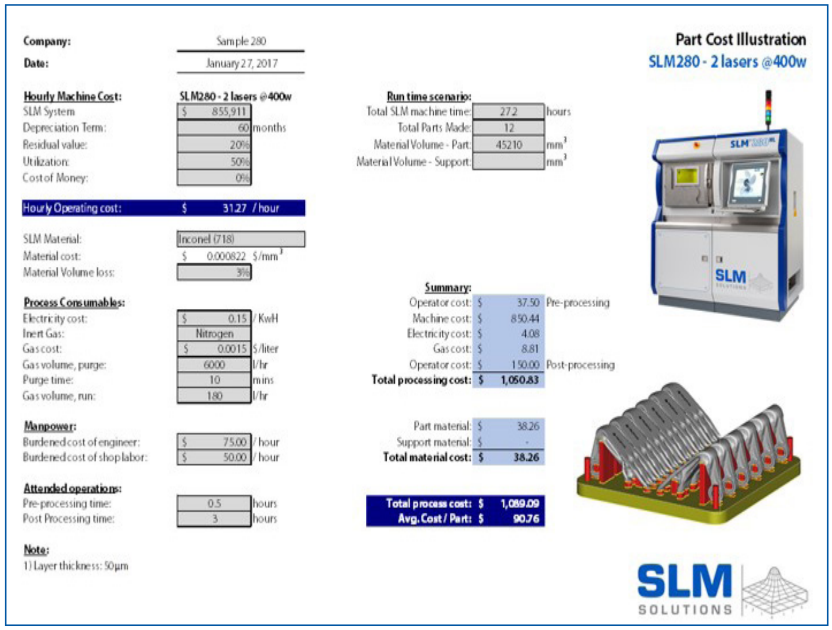
Other factors, such as humidity and flowability of your material will affect job quality, but the first step in identifying an optimized additive workflow is choosing a material processed by selective laser melting machines that you can source in high-quality powder.

The most common materials and alloys used in the SLM® process are: aluminum, titanium, cobalt-chrome, nickel alloys such as inconel and tool and stainless steels.

3. Is There Value?

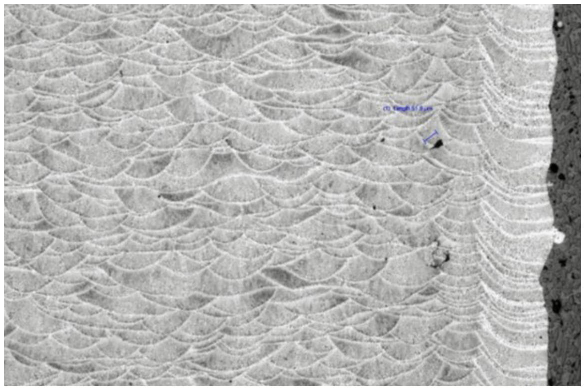
It's no secret that costs of running a metal 3D printer can add up. That's why it's important to make sure your part is a high value, high performance piece to maintain a healthy profit margin.

How does processing your material on a CNC machine compare? What affect does size or laser power of a machine have on your process productivity, thus to your cost per part? Determining value and part cost is well understood, and SLM Solutions has a part cost calculator to consider build time and material usage, machine purchase price, man hours and utility usage to assist in evaluating if additively manufacturing your part makes economical sense.



4. Can You Meet Your Performance Requirements?

Selective Laser Melting produces 99.9% dense metal right off the machine and can be considered as a casting replacement. However, metal produced through the metal additive manufacturing is its own material and should be regarded as such. Looking under a microscope shows that fused metal does not look like metal produced through traditional manufacturing processes and has its own microstructure. Here are some comparison points:



Surface Finish – surface roughness is within six micrometers compared to a casting or forging

Strength – 2-4% lower tensile strength than wrought material, selective laser melting is stronger than a casting

Accuracy – compared to a casting, selective laser melting is within 50-100 microns of accuracy across the build plate

Stress – as a welding process stress can build up in both the part and the plate. Some stress relief may be needed depending on your part design

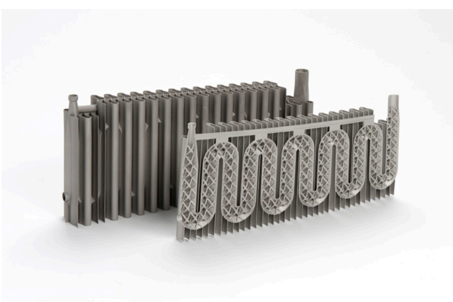
Density – 99.8% or greater metal density

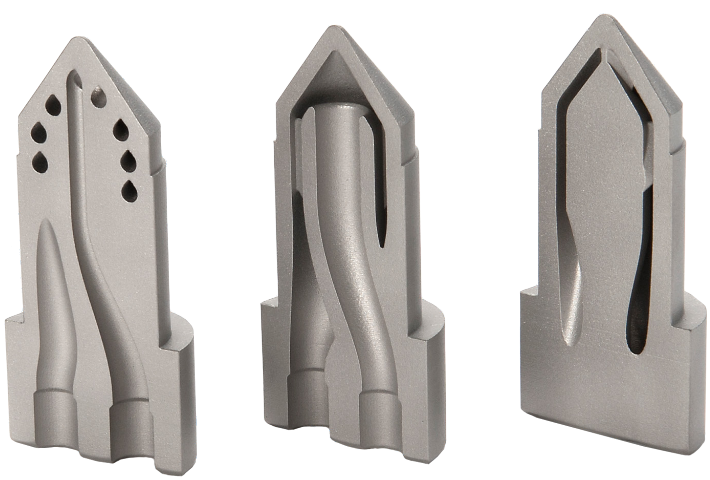
Hardness – selective laser melting produces hard material only a few points lower than wrought material. Heat treating can also be carried out to change the chemical properties of the material to increase hardness

5. Will Your Part Design Print?

A laser powder bed machine *can* print any type of part you load into it, but that doesn't mean you *should*. Evaluate if your part design makes sense for additive manufacturing; to get the most out of the cost to print parts you should have your part specifically designed for this process; printing a component designed by traditional CNC conventions will rarely be cost effective on a selective laser melting machine. Parts that may be optimized for lightweight may not be optimized for metal additive manufacturing due to factors such as supported angle and support removal during post-processing.

Design for additive manufacturing (DfAM) allows you to utilize the benefits of 3D printing such as bionic designs to improve the part strength and light-weighting or to integrate internal channels not possible through conventional manufacturing methods. Incorporated into these innovative DfAM designs will be considerations to build orientation on the selective laser melting machine and limiting or elimination altogether of the need for supports to be generated in the first place.





6. Does Your Part Design Require Post Processing?

"Just press print" doesn't produce the final product. There are a variety of post processing methods that depend on your material, design and requirements, and the time and resources needed to post process a build could make the part a bad fit for additive manufacturing. Some of the key steps to take into consideration as part of your entire process chain are:

Quality Verification – some options include destructive testing with tensile bars printed together with the part or a micro -CT scan to look for porosity and view how the internal material looks, like we do here at SLM Solutions. You can also conduct a CMM inspection to determine the dimensional accuracy of your part to verify it's the size you want it to be

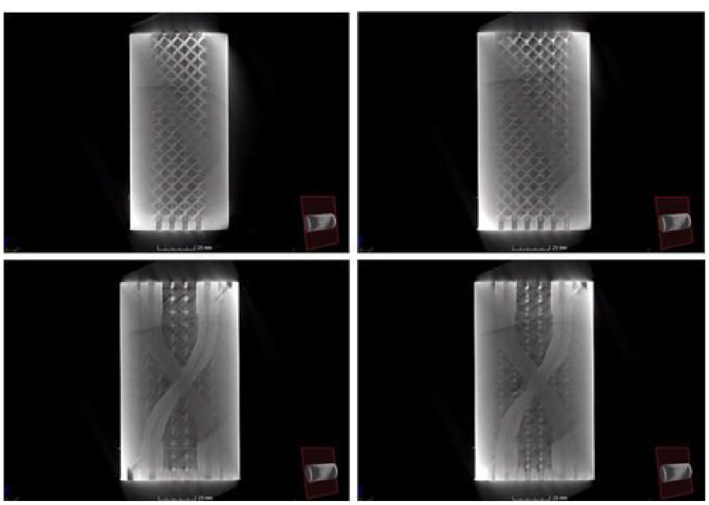
Stress Relief – heat treating is a very common requirement; before you remove certain types of parts from the build plate you will need to heat treat them so they do not warp

Hot Isostatic Pressing – although selective laser melting can produce 99.9% dense parts, HIPping can remove any residual porosity from a part, high heat at a high atmospheric pressure is applied, a common practice for aerospace parts, for example

Plate Removal – parts must be removed from the substrate plate through a band saw or EDM. Some DfAM parts are optimized with minimal supports to be broken off the plate by hand

Support Removal – support structures, necessary to anchor the part and dissipate heat during the build, will be the same material as your part, and will need to be removed. Design optimized parts may allow support removal to be removed by hand with pliers, while many vendors are developing new removal processes, such as electrochemical pulses, for example

Surface Finishing – electropolishing or grit blasting can significantly improve the surface of your parts, which can be processed to a mirror finish, if required



Need more help?

Contact SLM Solutions today, we'd be happy to walk you through how to evaluate your specific part!

1.248.243.5400 | info@slm-solutions.us

SLM Solutions - Technology Pioneers, Innovation Leaders

SLM Solutions helped invent the laser powder bed fusion process, was the first to offer multi-laser systems and all selective laser melting machines offer patented quality, safety and productivity features. Taking a vested interest in customers' long-term success in metal additive manufacturing, SLM Solutions' experts work with customers at each stage of the process to provide support and knowledge-sharing that elevate use of the technology and ensure customers' return on investment is maximized. Optimal paired with SLM Solutions' software, powder and quality assurance products, the SLM® technology opens new geometric freedoms that can enable lightweight construction, integrate internal cooling channels or decrease time to market.

A publicly traded company, SLM Solutions Group AG focuses only on metal additive manufacturing and is headquartered in Germany with offices in China, France, India, Italy, Russia, Singapore and the United States and a network of global sales partners.






SLM Solutions Americas

As part of our commitment to partner with customers, SLM Solutions Americas has a customer experience center in Metro-Detroit to foster collaboration on projects. Partnering with our colleagues in Germany, our local team of North American experts, including service, application, and systems engineers, provide full installation, maintenance, training and other learning opportunities, allowing us to harness the capabilities and exercise best practices for selective laser melting.

SLM Solutions North America | 48561 Alpha Drive, Suite 300, Wixom, MI 48393
1.248.243.5400 | info@slm-solutions.us | www.slm-solutions.us

SLM Solutions Group AG | Estlandring 4 | 23560 Lübeck | Germany
+49 451 4060 - 3000 | info@slm-solutions.com | slm-solutions.com