

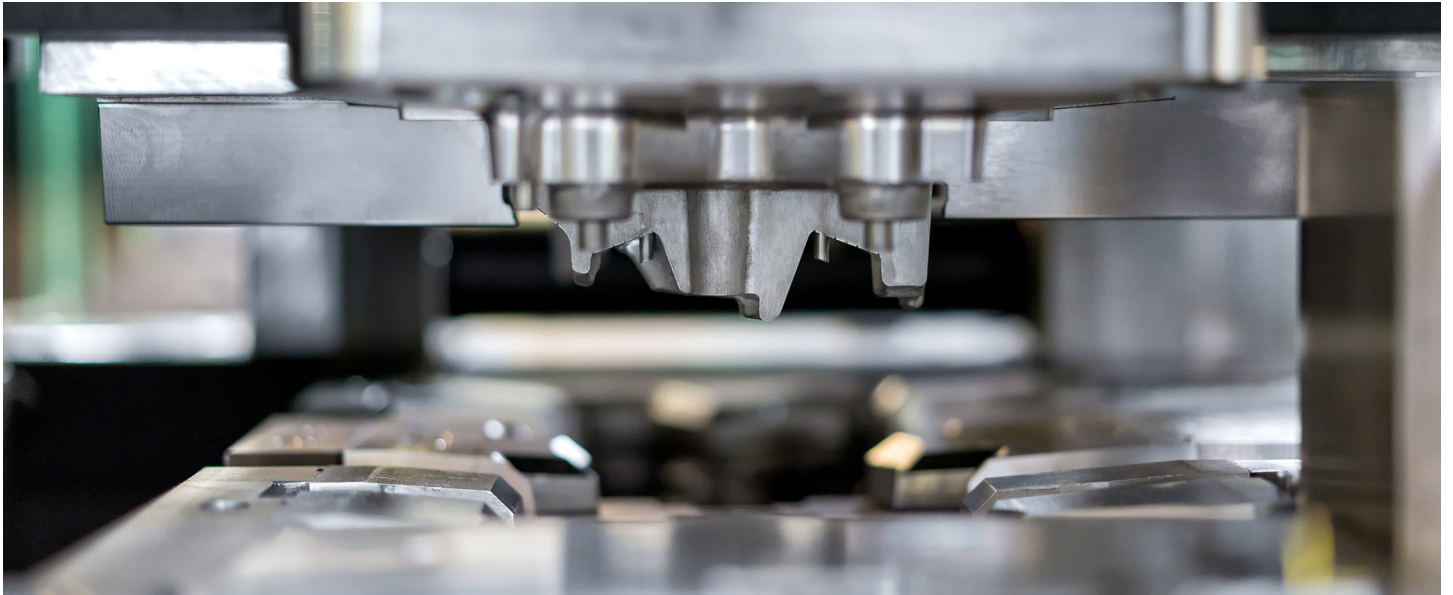


Showcase Die Casting Tooling with MetalFab 300 Flex



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Additive Manufacturing technology is enabling many opportunities for enhancing mould tool performance, and the MetalFab 300 Flex offers tooling manufacturers with a flexible entry point to introducing the technology for small & large tools.



Introduction

The potential for metal Additive Manufacturing (AM) technologies to be utilised in the tool and die sector with both plastic metal injection moulding and pressure die casting is well established and very high. The design freedom that is possible with AM allows for the production of tools and inserts for both processes with advanced internal cooling structures such as conformal channels, heat sinking and more, as well as opportunities for material cost and weight savings. These advanced designs, when produced using tool steel materials which are hardenable in a conventional manner, allow for improvements to be realised in terms of casting/moulding cycle time, increased tool life and better part quality. However, the challenge for traditional tool makers to adopt AM technology is often due to the financial commitment required to invest in the equipment - particularly if they are aiming to produce larger tools which can yield the biggest benefits. Additive Industries have been working to lower this financial barrier, and to help this have launched the MetalFab 300 Flex.

MetalFab 300 Flex

MetalFab 300 Flex is an entirely new model of flexible metal additive manufacturing. It's the only printer that lets you increase your build area on demand, so you can invest in extra size or capacity only when you need it. It's the same trusted, market-proven printer technology we've refined over years and more than a million production hours, now more affordable and accessible to newcomers than ever before.

This approach represents a great opportunity for tool makers looking to begin the adoption journey, because only investing in a small system means the learning journey and initial implementation is financially de-risked, however if a requirement arises to produce a larger tool the flexibility allows this via purchasing a monthly or perpetual license to increase the build area from 300x300 to 420x420mm. This requirement may only exist for 1 or 2 tools, so once they have delivered the tool they can revert back to the smaller build area and lower associated operating costs.

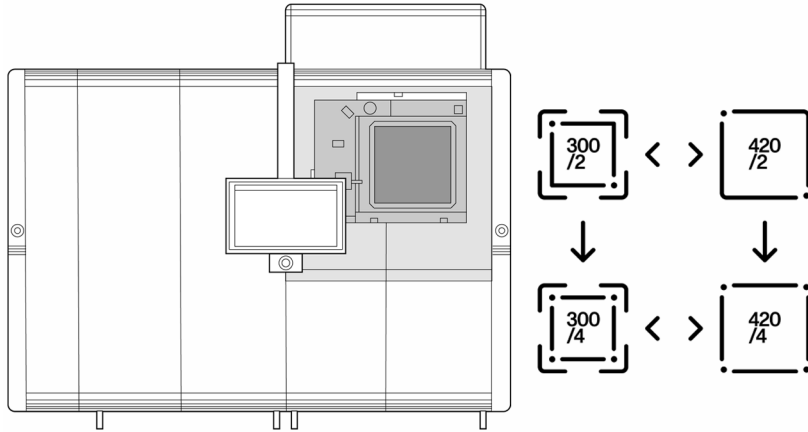


Figure 1. MetalFab 300 Flex diagram - flex between 300 × 300 and 420 × 420mm build area, and also add additional lasers (in-field upgrade)

Material	M300 Tool Steel
Dimensions	152 × 90 × 113mm
Mass	5kg
Key Features	Conformal cooling channels
Application	Industrial pump housing die insert

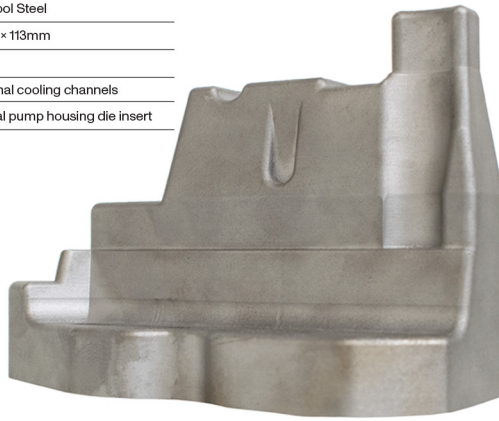
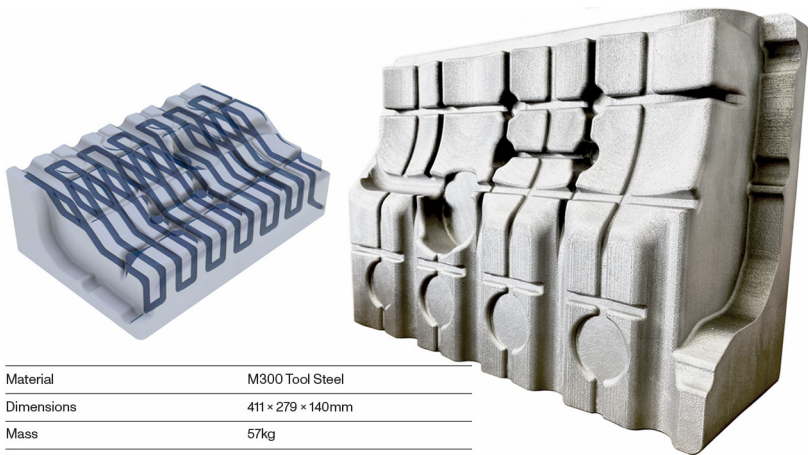


Figure 2. Small die insert



Material	M300 Tool Steel
Dimensions	411 × 279 × 140mm
Mass	57kg
Key Features	Conformal cooling channels
Application	Automotive engine block die insert

Figure 3. Large die insert

Tooling Examples

To demonstrate the benefits of the MetalFab 300 Flex, two die inserts have been selected with the various possible build layout scenarios examined and demonstrated. Both are produced using M300 / 1.2709 tool steel which is one of the materials released by Additive Industries for tooling applications on all MetalFab systems.

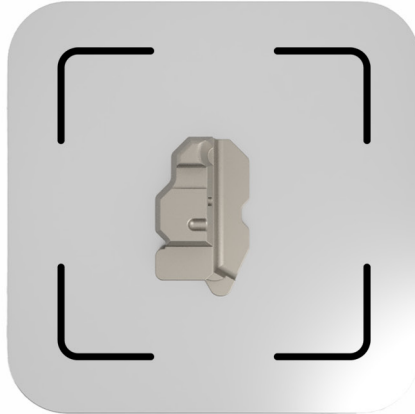
The first example is a small die cast tool insert. This insert is part of a larger die, and forms a deep pocket of an industrial pump housing aluminium casting. This is a common approach in tool design, as it breaks down the die into smaller units which can be replaced over time as they wear without the need to fully replace the entire die. The insert measures 152 × 90 × 113mm, weighs 5kg and contains a complex internal conformal cooling channel loop of which the key benefits of the AM solution are improved cooling which leads to shorter cycle times and longer tool life.

The second example is a much larger tool which forms one side of an automotive engine cylinder block, cast in aluminium. This tool demonstrates the possibilities with the MetalFab 300 Flex when the build area expansion license is activated, pushing the limits of the 420 × 420mm build area to its maximum. The tool showcases what can be achieved on the system with such a large piece, with dimensions of 411 × 279 × 140mm and final mass of 57kg, with the benefit of integrated conformal cooling channels which add to reduction of cycle time and longer tool life. Further to this, the design incorporates various mass reduction features to both reduce the material used, reduce the printing time and control distortion with reduced residual stress.

The MetalFab 300 Flex includes 2 x full field lasers which is not standard on large systems. This technology offers significant benefits for tooling manufacturers compared to the more conventional zonal laser approach. With larger volumes and scanning areas it allows the most efficient utilisation of the lasers, enabled by the Additive Industries Dynamic Laser Assignment (DLA) software allowing multiple lasers to work as one across an entire build area without so called stitch zones. The system can also be upgraded in the field to 4 lasers, further increasing its flexibility and the potential for increasing output.

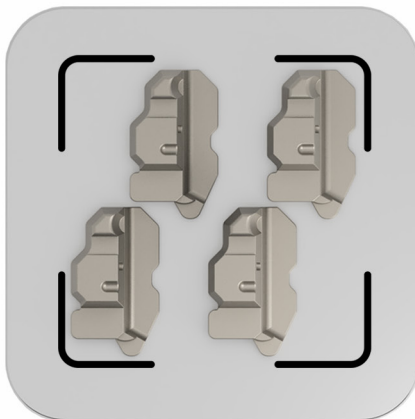
For both of these two insert designs, it is also possible to implement a hybrid approach to manufacturing, where instead of building onto a standard baseplate, the first section of the insert is milled conventionally and mounted into the MetalFab, with the rest of the tool printed directly onto the base. This approach is particularly beneficial to save build time and reduce post processing time (cutting from base plate), and one which the MetalFab 300 Flex lends itself too very well due to its highly accurate and repeatable X,Y positioning of its base plate through kinematic mounting.

1



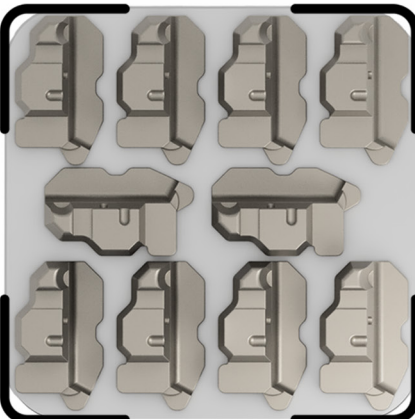
Base system with 300 x 300mm build area ideal for manufacture of small die inserts/single tools.

2



Increase output by batch processing multiple tools with maximum laser efficiency due to full field lasers.

3



Purchase a temporary license for 420 x 420mm build area expansion if more output is needed for a specific project.

4



Expand to 420 x 420mm build area if a requirement arises to build larger tools. Upgrade to 4 x full field lasers if more productivity is needed.

MetalFab 300 Flex Layouts

Part Dimensions	152 × 90 × 113mm
Total Volume	595cm ³
Total Mass	5kg
Build Time/Part	19.75hrs
Guide Cost/Part*	€1,750

Part Dimensions	152 × 90 × 113mm
Total Volume	2380cm ³
Total Mass	20kg
Build Time/Part	16.6hrs
Guide Cost/Part*	€1,030

Part Dimensions	152 × 90 × 113mm
Total Volume	5950cm ³
Total Mass	50kg
Build Time/Part	15.9hrs
Guide Cost/Part*	€930**

Part Dimensions	411 × 279 × 140mm
Total Volume	7171cm ³
Total Mass	57kg
Build Time/Part (4 lasers)	85hrs
Guide Cost/Part*	€10,030**

*based on 7 year amortization + time dependent license fee

**+ monthly build area expansion license fee to be spread across increased monthly output

Summary

The MetalFab 300 Flex can demonstrate high potential for manufacturers of mould tooling, whether for metal die casting applications or injection moulding. Alongside the design freedoms unlocked through advanced tool design common for all AM technologies, the system offers tool makers the cost effective low barrier to entry into the implementation of metal AM, but with the added confidence that investing in a small system will not restrict them from manufacturing large tools as and when the requirement arises.

Through leveraging design freedoms, it is shown that material savings can be made versus conventional milled tools, which have advantages for handling of heavy tools as well as reducing material consumption and ultimately managing tool cost.

Further to this, it is demonstrated that the system is capable of producing a range of die inserts ranging from relatively small 5kg inserts through to large 60kg tools with high quality material and complex internal geometries - the system flexing between large and small build areas on demand.

Investing in a MetalFab 300 Flex system, tool makers can develop their own knowledge and internal capabilities to design and manufacture AM moulds and dies with the long term objective of producing large units, but without the large financial risk at the outset. However, by working with the smaller build envelope and expanding to the larger platform when needed there is no need to develop different processing strategies, parameters or re-train staff as the system architecture remains common.





At Additive Industries, our objective is the success of our customers in achieving the lowest cost per part at market leading part quality.

We pride ourselves on our flexibility to work with our MetalFAB users in achieving their industrial goals.

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