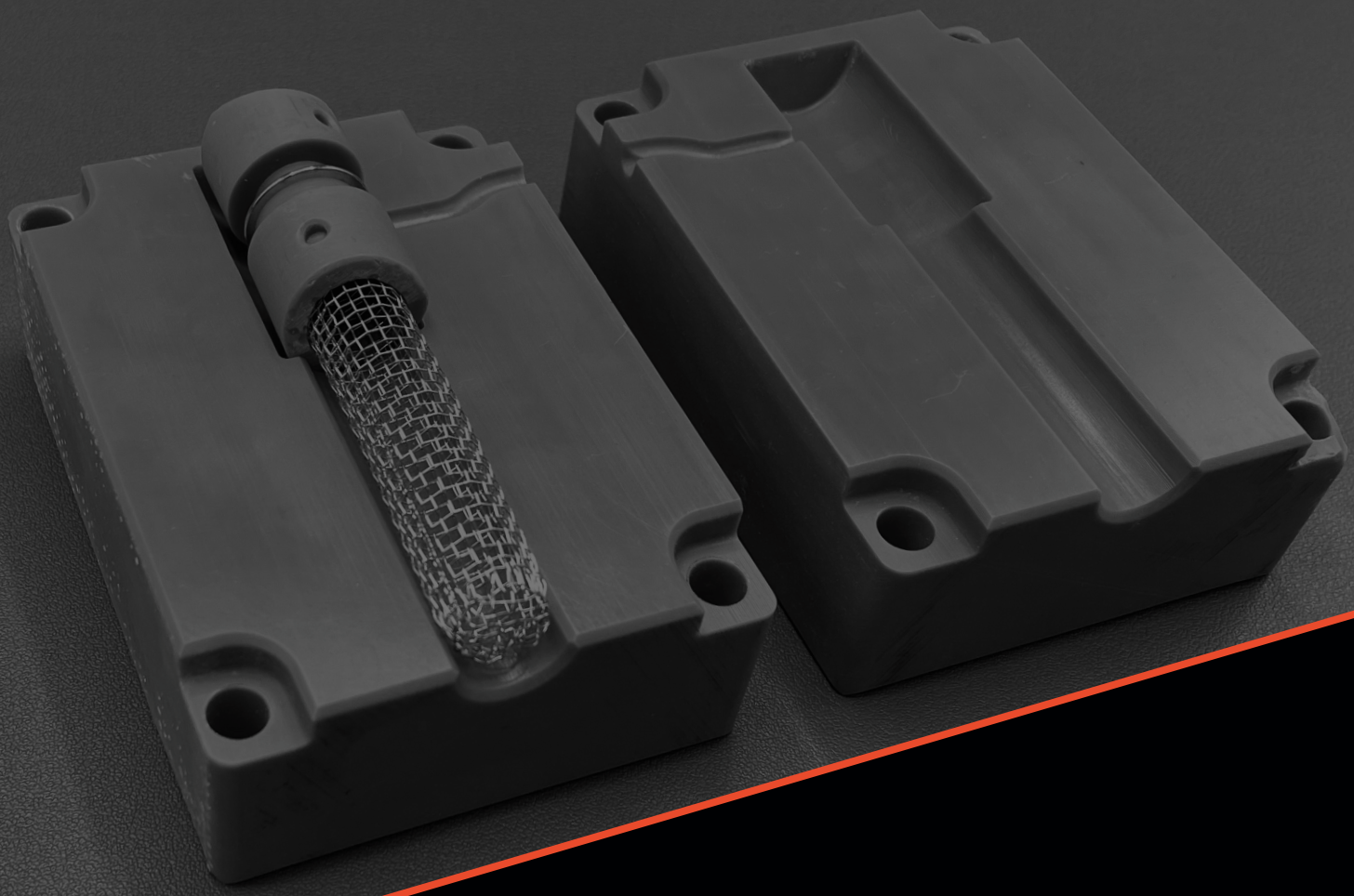
FORTIFY



Quick-Turn Tooling Relieves Supply Chain Issues for Low-Volume Overmold Production

CASE STUDY

I.

INTRODUCTION

Fortify put their value of quick-turn molded parts to the test when they needed a low-volume overmolded part on their 3D printers, but were running up against supply chain issues. The 3D printer manufacturer still overmolds these parts with their 3D printed tools today.

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THE CHALLENGE

The go-to solution for overmolding is metal tooling, either aluminum or hardened steel. This is a perfectly acceptable method in a high-volume production environment, and easy to justify the high tooling cost.

However, for prototyping and low-volume production, the high tooling cost is a major barrier to meeting budgets and timelines. The option to use CNC machining drives up lead times and cost significantly. The other option is to direct 3D print parts, which can emulate the overall shape of the plastic part, but are not in the end-use material that will be used in production. Despite advances in 3D printing technology, there is currently no way to overmold or use inserts for direct printing on a 3D printer.

Not only is the lack of alternative methods making it difficult to get overmolded parts, the constraints on the supply chain are driving up the already high tooling costs and exploding lead times from the normal 4-6 weeks into 3-4 months.

Many start-ups and machinery manufacturers have a need for molded parts in low quantities, on the order of 5 to 5000 pieces per year. For metal components it is easy enough to get them from a sheet metal supplier or machine shop, but for plastic components there isn't a simple solution. Except for when your company specializes in fast, cheap, and low-volume molding.

WAITING 3-4 MONTHS FOR A TOOL HAS BECOME STANDARD WITH NEW SUPPLY CHAIN CONSTRAINTS

I.

THE SOLUTION

Fortify, a provider of 3D printers for advanced photopolymer composites, focuses on a range of applications including 3D printed mold tools. With a base resin fortified with ceramic fibers, Fortify's 3D printed mold tools are stronger, stiffer, and have a higher heat deflection temperature than other 3D printed mold tools. This means these mold tools are able to produce shots in a range of molded materials, including high-performance plastics. This is a fast, and cost-effective solution for prototyping and low-volume production of parts that need to be molded - such as in the case of overmolding.

The decision to look inward for an overmolded production filter was an easy one when compared with other tooling costs. Although it started as a prototype, the overmolded filter has now found its way onto the production line and into the first series of production of Fortify's Flux Series Printers.

Because the part in need required a metal filter to be overmolded with a polypropylene collar, the Fortify printer manufacturing team inquired into getting a standard metal tool and was given quotes from $10,000 up to $22,000 from competitive low-volume molders. This pricing is very common as there is no alternative way to make them. The lead times were quoted at 6-12 weeks for an aluminum tool.

Because Fortify is equipped with an ultra durable tooling resin, a mold design team, dedicated process engineer, and a mold press located on site at Fortify HQ, the printer manufacturing team was able to leverage Fortify's in-house injection molding services. The cost of services including: mold design, tooling resin, labor, and press time was $4200. 3D printed tooling allowed Fortify to save tens of thousands of dollars in tooling costs while still being able to produce production quality parts and avoid any supply chain snags by fulfilling the order entirely stateside in just three days.

An overmolded filter, procured from Fortify's injection molding services, was put into the production line of Fortify's FLUX Series 3D printers.

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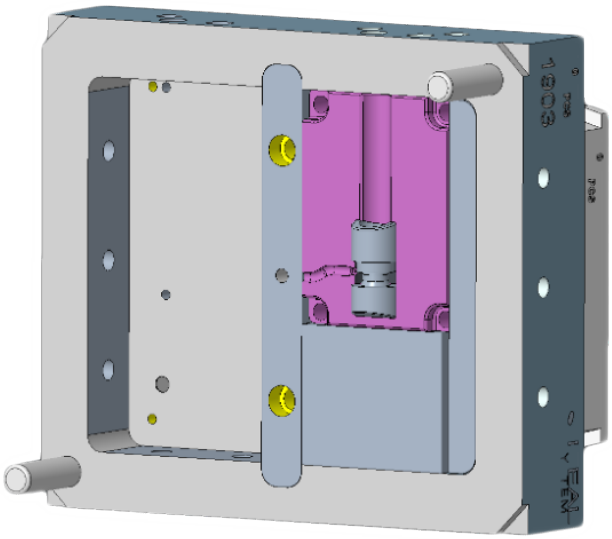
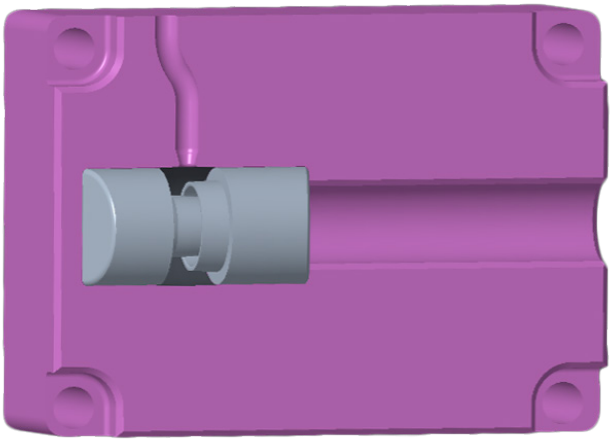
PROCESS

Designing a mold begins by importing the part into the Mold Master file. This includes a pocket and ejector pin layout for the custom 08/09 MUD frame that is used for all of Fortify's mold tools. This custom mold frame maximizes the design flexibility that is necessary for the team to complete multiple customer projects every week. By utilizing a modular set up and CAD master model, mold design time is cut down from days to hours, and is typically finished the same day a part is reviewed with a customer. This particular mold was relatively simple. The most challenging feature was the fixturing for the filter and the insert design to ensure the flow is shut off around the plastic collar - keeping it from leaking into the mesh. The team completed the design in 4 hours without any need for complicated slides, lifters, side actions, or any other automated ejection/fixturing strategy by using a hand loaded insert approach. A simple assembly of a short sleeve around the filter and a plug for the middle was used to create the part geometry. This simple assembly would have cost thousands of dollars to design and machine in a competitive shop.



A CAD image of the 3D printed mold tool to fit inside the custom MUD frame. The modular frame includes a pocket and pins, allowing for quick turnover of tools.



The tool was designed with a hand-loaded insert, eliminating the need for complex features.

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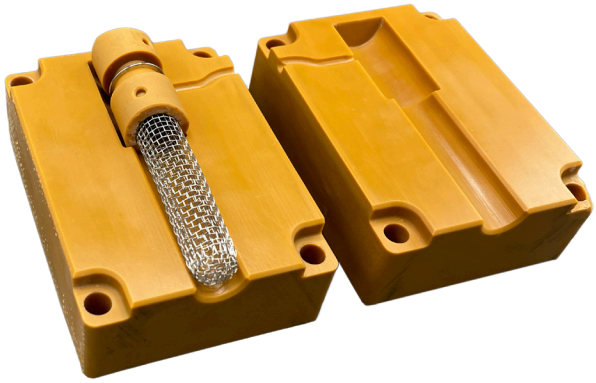
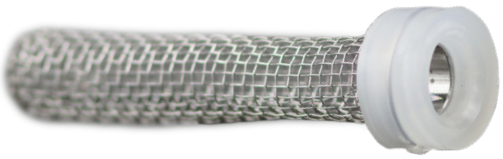
As a result of completing the mold design in less than 4 hours, the mold was printed that night, for about 11 hours and used only $300 of Digital Tooling(DT), Fortify's proprietary tooling resin. Once printed the mold is removed, cleaned, and post-cured by Fortify's print engineers and technicians. The option to have the mold polished or media blasted was offered, but for a simple filter that is not an aesthetic part, they were not exercised. The total hands on time for cleaning the mold is about one hour including support removal, wiping, and UV curing. Once UV cured, the part is put into an 8 hour bake cycle to thermally cure the part, similar to an annealing process. After the thermal cure, molds are given a surface treatment and then handed off to the process engineering team to be molded.

Just two days from receiving the finalized part CAD, the printed mold inserts are ready to be put in the frame and run. In only five minutes, the inserts are aligned in the frame and the frame is loaded into the 30 ton Nissei NEX-IV. The Fortify molding process is a modified version of scientific molding where the process is limited on the injection pressure and instead driven by time and position. Fortify's molding services are generally used for low part quantities, so the long cycle times for printed tooling are not a barrier for customers. Fortify molding processes regularly see fill times from .5 seconds up to 7 seconds and hold times ranging from 10-15 seconds. Overall cycle times for Fortify molded parts range from 1-3 minutes on average. This particular part was just over two and a half minutes due to the hand loaded inserts. Taking about an hour and a half, the entire order was fulfilled on the third day of the project and handed off to the manufacturing team where the filters were then placed into production printers.



The mold tool is printed in DT (Digital Tooling) - a rugged resin ideal for tooling and applications requiring high temperature stability.



This low-volume production part is manufactured via Fortify's 3D printed mold tools and then overmolded by Fortify's injection molding services.

The total time for part design to molded parts in hand took 3 days.

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RESULTS

In just three days the mold for the filter was designed, printed, post processed, molded and assembled into production printers. By side stepping the backed up supply chain and using 3D printed tooling, the Fortify manufacturing team was able to get their overmolded parts in less than a week. The total order was 25 parts with the ability to reorder at a significantly reduced timeline as the mold was already designed and printed. The robust and durable nature of the DT means that the team is able to reuse the tool, making monthly or quarterly ordering of this part fast and inexpensive.

ABOUT FORTIFY

Fortify is transforming the 3D printing industry with its patented DCM (Digital Composite Manufacturing) platform. DCM delivers new levels of additively manufactured part performance by introducing functional additives to photopolymers. By combining a deep understanding of material science with high performance mixing, magnetics, and polymer physics, Fortify is able to produce custom microstructures in high-resolution 3D printed parts.

The company is currently focused on applications ranging from injection mold tooling to high performance end-use parts with unique mechanical and electromagnetic properties. Founded in 2016 and based in Boston, Fortify technology enables material properties and components unattainable using other additive or traditional manufacturing processes. For more information, visit www.3dfortify.com.

FORTIFY

WWW.3DFORTIFY.COM
SALES@3DFORTIFY.COM
75 HOOD PARK DRIVE, BLDG 510, BOSTON, MA 02129