MANTLE

PRODUCTION TOOL CASE STUDY

800,000 Parts and Counting: Mantle 3D Printed Inserts Compared Side-by-Side to Machined Inserts in High-Volume Molding Study

- After 400,000 molding cycles, Mantle's 3D printed inserts were just as accurate and durable as conventional inserts
- 3D printed P2X, H13 inserts produced weeks faster than conventionally machined S7 inserts

Case Study Summary

Tessy Plastics Corp. has been participating in an innovative benchmarking program to assess the accuracy, durability, and reliability of Mantle's 3D printed metal mold inserts being used in a high-cavitation injection mold to produce high-volume personal-care products. Instead of conventionally machining away material from a solid block of metal (subtractive manufacturing), two test inserts were additively manufactured via Mantle's TrueShape technology. After 400,000 cycles, Mantle's 3D printed P2X and H13 inserts have proven to be as accurate and durable as machined inserts with S7 steel - and are performing just as well. All 800,000 molded parts produced have passed Tessy's internal quality control checks and are being shipped to the customer. Tessy also calculated that the printed inserts could be produced weeks faster than conventional machined inserts.

Mold insert used in study

Customer Profile

Founded in 1973, Tessy Plastics is a global contract manufacturer headquartered in Skaneateles, NY, specializing in injection molding and custom automated assembly solutions. All of their facilities are FDA/GMP compliant and add up to more than 1.7 million square feet, including 147,000 square feet of ISO Class 7 & 8 clean room manufacturing. Through comprehensive engineering and research & development, they provide superior quality and speed to market. Contributing to the Medical, Pharmaceutical, Diagnostics, and Consumer markets allows them to leverage their expertise over a wide range of products. Their capabilities include product design & development, rapid prototyping, tool design & build, medical automation design build, plastic injection molding, and complex medical & consumer assembly.

Product Challenge

While Tessy's moldmaking team is interested in the benefits that 3D printing brings—including the ability to produce unique geometry and include highly complex conformal cooling lines to help reduce molding cycle times and part rejects—their primary focus is on how accurate and durable additively manufactured metal components are and whether they can be produced faster and at lower cost than conventionally machined mold components. Rich Smith, Tessy Engineering Manager, stated, "While it's great to be able to print geometry that you can't achieve in conventional manufacturing and incorporate conformal cooling to reduce cycle times, we considered those nice side benefits that we'd take advantage of only if we were convinced the technology would meet our needs. Our primary concern was how well 3D printed inserts would hold up over time and how they'd compare with conventionally machined inserts in terms of wear, durability, and accuracy after hundreds of thousands of manufacturing cycles."

"While it's great to be able to print geometry that you can't achieve in conventional manufacturing and incorporate conformal cooling to reduce cycle times, we considered those nice side benefits that we'd take advantage of only if we were convinced the technology would meet our needs. Our primary concern was how well 3D printed inserts would hold up over time and how they'd compare with conventionally machined inserts in terms of wear, durability, and accuracy after hundreds of thousands of manufacturing cycles."

— RICH SMITH, TESSY ENGINEERING MANAGER

For its test program, Tessy selected an established production mold that already had 4-million cycles on it and that was producing parts that had only a couple of key and easy-to-measure dimensions, thus making qualification simpler and faster. The mold has 32 cavities and produces 6,500 deodorant-stick thumb-screw wheels in a highly nucleated grade of polypropylene each day. Each cavity is equipped with a slide (on the core side) and each slide contains an insert that is used to core out the thumb-screw wheel. The insert averages 2.5 in./64 mm in diameter, is 1.8 in./46 mm wide at the bottom, and is 2.72 in./69 mm tall.

The Solution

Three of the mold's 32 inserts were replaced with new inserts: one printed with Mantle's P2X material, one printed with Mantle's H13 material, and one newly-machined S7 insert to match the other 29 inserts in the tool. Since Tessy was especially interested in understanding the economics of 3D printing, Tessy and Mantle kept track of the time required to produce both the 3D printed inserts and the conventionally machined insert to more accurately compare additive and subtractive manufacturing options.

It took Mantle's team 54 hours to print each mold insert, compared with roughly 150 hours over three weeks for the machined insert. Tessy did minor finishing on the 3D printed inserts that totaled an extra 6 hours.

Evaluation Results

The 2 printed inserts and the new machined insert have been running in the tool since February 2021. By August 2021, the tool had been cycled 400,000 times. All 800,000 molded parts produced have passed Tessy's internal quality control checks and are being shipped to the customer.

Cost & Time Comparison: P2X, H13 Printed Inserts vs. Machined S7 Insert

Comparison Area	Conventional Inserts	Mantle	Savings
Time	150 hours over 3 weeks	60 hours	60% Faster

Mantle helps manufacturers bring new products to life faster, cheaper, and more easily than ever before with its patented TrueShape™ metal 3D printing technology. TrueShape™ delivers precision inserts that dramatically cut the time and cost of making production-grade tools, molds, and dies. Mantle tools have been used to produce over one million end-use parts for customers - a number that grows each day. Mantle is headquartered in San Francisco, California. To learn more, visit mantle3d.com.

MANTLE