

# Hundreds of Thousands of Shots and Counting: Full Production Run Performance Achieved with a Mantle Printed Mold Insert

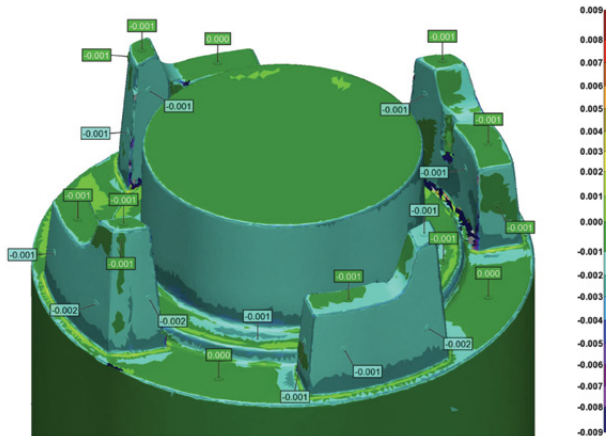
- Met production specifications for dimensional tolerance and surface finish without post-processing
- No difference in tool wear between Mantle insert and conventional insert
- Reduced lead time by over 70% and cost by over 65%

## Case Study Summary

A global manufacturer of consumer appliances replaced an existing plastic injection mold component in a high-volume dishwasher mold with a component printed using Mantle technology. The part took 46 hours to print using Mantle's TrueShape™ process, compared to a lead time of 1 week with conventional manufacturing, a 71% time savings. The Mantle insert quality was equivalent to traditionally-manufactured inserts, with dimensional tolerance within 0.001" and a smooth surface finish. The insert was ready for molding without additional surface finishing. The evaluation led to a full production run of 200,000 parts and continues with another 200,000 part run, which is currently underway. The replacement printed insert cost was 67% less than the cost of the same insert produced using traditional methods.



Printed mold component after printing with no-post processing



3D scan of critical component dimensions showing  $\pm 0.001$ " accuracy

## The Challenge

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Tooling requirements for consumer appliances are highly customized and demand consistent precision. Production tools must be continually monitored and worn tools must be repaired or replaced to ensure ongoing production. Conventional methods used for tool replacement are time-consuming and can cause production outages if tools are down for repair.

As part of an initiative to improve production uptime, the company evaluated Mantle's TrueShape™ technology to print a replacement mold insert for a plastic injection mold used in their dishwasher production line. For a true head-to-head comparison, one of the 8 inserts in the tool was replaced with an insert produced by Mantle's TrueShape™ technology and P2X material. The component was printed in 22 hours and sintered in 24 hours, for a total production time of 46 hours. The company evaluated the performance and longevity of the Mantle insert in a high-volume production environment.

## Pre-Production Qualification

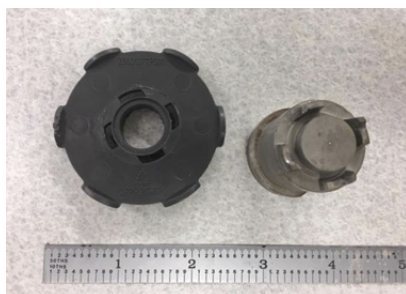
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Prior to being placed into full production, the printed insert was subjected to a thorough quality analysis to ensure it conformed to the tool specifications. The insert was analyzed with a precision 3D scanner and dimensions were confirmed to be within 0.001" of the CAD data, meeting the requirements for this application. The 3D scan data was retained to enable monitoring of tool wear during subsequent maintenance cycles. A surface finish analysis demonstrated that the as-printed finish was less than 2 μm Ra without any surface finishing, which was within the specification for the tool. The insert was then installed into the mold pocket in the larger base with minimal fitting.

Initial molding trials showed that the plastic parts produced by this insert met production specifications for both dimensional tolerance and surface finish. With this validation, the company's manufacturing team put the mold insert into high-volume production and monitored part quality for the duration of the production run.

## Production Results

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After nine months and a 200,000 plastic part production run, the insert was removed during a routine injection molding machine maintenance interval. The production team rescanned the insert and compared the data to the initial pre-production scan to check the lifetime remaining on the insert. Showing only minor wear at expected points, the insert was reinstalled and put back into production for another production run of 200,000 parts.

The evaluation results were positive across all criteria for the 200,000 production run. The plastic parts produced by Mantle's insert met quality requirements for the run and performed identically to those molded with the traditionally-manufactured inserts.

## Business Impact

Initial mold trials made with Mantle's TrueShape™ technology yielded production-ready results equivalent to conventional manufacturing, with significant cost and time advantages. Using Mantle's technology, the trial insert cost was cut 67% percent and produced in 71% less time. After the success of the initial run, the insert will continue in production with a goal of producing more than 500,000 parts, which would match the expected lifetime of traditionally-manufactured inserts. Based on the successful evaluation and production run for the dishwasher application, the company is currently mapping out future plans to evaluate Mantle technology in other products and applications.

## Evaluation Results Comparison

Comparison Area	Conventional Approach	Mantle
Time	1 week	<2 days of printing and sintering time (46 hrs)
Component Cost	\$1,875	\$624 for single part, \$225 each when printing 4 parts at the same time
Processing steps after insert creation	- Fitting into mold base - Mold texturing	- Fitting into mold base - (No texturing required)

Comparable yield to production baseline.

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 parts that dramatically cut the time and cost of making production-grade tools, molds, and dies. Mantle tools have produced hundreds of thousands of parts for customers - a number that grows each day. Mantle is headquartered in San Francisco, California. To learn more, visit [mantle3D.com](http://mantle3D.com).