Cost Efficient 3D Printed Mold for Thermoforming

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Engineering Design Manufacturing, and Management Systems

Current Industry Information

Aluminum molds are expensive to produce. Ranging from $2,000 to $10,000 per mold. The molds are also time-consuming taking weeks to produce and receive. The primary purpose of these molds is for high volume productions of parts. There is a need for an affordable mold alternative for small batches of parts.

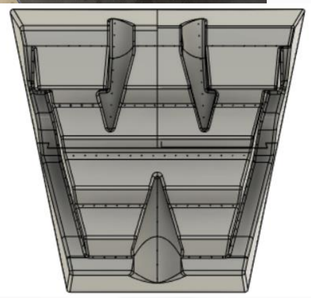
Project Objectives

- Create a cost-effective mold using 3D printing
- Prepare and test prototype
- Fabricate new mold
- Analyze mold deterioration

Original Mold

- Originally an SPE project
- 3D printed in 3 different parts
- Connected with epoxy
- Needed a larger custom-built vacuum table

Original Mold Changed to Account for Machine Capabilities



Preparation Process

- Tested original mold
- Drilled through existing holes to remove blockage
- Removed extra support material
- Fabricated new vacuum table
- Redesigned CAD model for mold
- 3D printed new mold

Final Part

Testing

- Established testing parameters
- Determined process run time on thermoform machine
- Ran 100 parts on mold
- Recorded deterioration of mold over time

New Mold Development

1st Model – Too Large

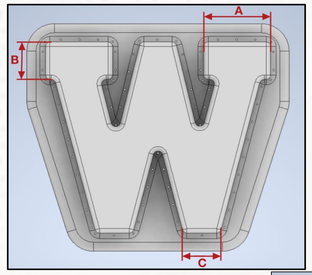
2nd Model – Not Enough Support

Final Model

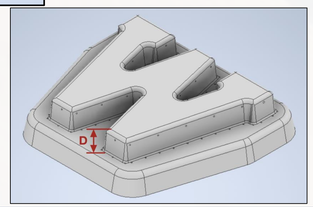
Critical Dimensions

- Show a couple of the main features of the mold
- Will be continuously measured
- Established to see how the mold will deteriorate over time

Critical Dimensions	
Level	Distance (in)
A	1.733
B	0.984
C	0.991
D	0.744



Critical Dimensions of Mold



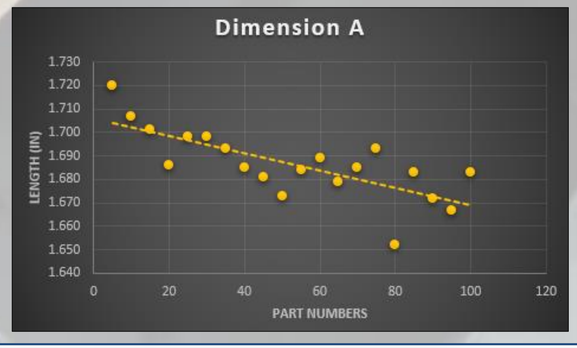
Data and Analysis

- Measured critical dimensions every five parts
- Total process time for one part was five minutes

Summarized Data of Critical Dimensions

Part #	Heat %	Time (s)	Cool Time (m)	A (in)	B (in)	C (in)	D(in)
5	80	13	2	1.720	0.955	0.988	0.740
20	80	13	2	1.686	0.951	0.982	0.745
30	80	13	2	1.698	0.939	0.997	0.740
40	80	13	2	1.685	0.953	0.945	0.737
50	80	13	2	1.673	0.935	0.982	0.735
60	80	13	2	1.689	0.938	0.955	0.731
70	80	13	2	1.685	0.933	0.964	0.736
80	80	13	2	1.652	0.935	0.927	0.761
90	80	13	2	1.672	0.921	0.951	0.738
100	80	13	2	1.683	0.901	0.944	0.738
Total Deterioration:				3.95%	3.56%	4.45%	0.27%

Deterioration of Dimension A over time



Conclusion

- The mold ran efficiently for 100 parts
- Had a max decrease in critical dimensions of around 4.5%
- Therefore, the mold is efficient for small runs of up to 200 parts

Acknowledgements

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