

Handbook

Vacuum Casting Guide



For beginners and professionals

IN3DTEC V6.2.1

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IN3DTEC TECHNOLOGY CO., LTD.

3D Scanning & Reverse Engineering | 3D Printing | CNC Machining | Vacuum Casting | Injection Molding |
Product Design

Digital manufacturing services for prototyping & on-demand production

info@in3dtec.com; www.in3dtec.com

1 >> The basics

1.1 What is vacuum casting

Vacuum casting is a copying technique used for the production of small series of functional & high-quality end-use plastic parts. It is a casting process for plastics using a vacuum to draw the liquid material into the mold, then put it into oven for getting the final solid parts.

1.2 Overview of vacuum casting process

The process starts by placing a two-piece silicone mold in a vacuum chamber. The raw material is mixed and degassed and then poured into the mold. The vacuum is then released and the mold removed from the chamber. Finally, the casting is cured in an oven and the mold removed to release the completed casting.



- Get the 3D Model ready: Format in STP or STL
- Make the master: By using SLA 3D Printing or CNC machining
- Make silicone mold: Put the master in a wooden box and fix it, then pour the silicone solution into the box

- The master mold is ready: After waiting for the silicone to completely solidify, cut the silicone in half and remove the master inside
- Pour the mixed PU raw material into the mold
- Take out the finished product

1.3 Pros and cons of the vacuum casting

Pros

Prices and deadlines

The use of silicone for the mold allows a reduction of costs compared to an aluminum or steel molds. In addition, you can achieve economies of scale from small quantity. Finally, it takes 7 to 10 days to get 30 to 50 functional prototype parts, making it an attractive method to meet urgent needs.

Quality of the part

The use of resins allows you to choose a material as close as possible to the right material, with a wide choice of hardness, flexible or rigid, but also the final appearance (the part can be colored in the mass or else have a 'crystal' type transparency). It is also possible to create over-molding (for example with brass inserts) and produce painted finishes.

High precision, fine detail

The silicone mold makes it possible to obtain parts totally faithful to the original model, even with the most complex geometries (undercuts and draft not required). The result is perfect, with quality comparable to the final part.

Cons

The lifetime of the mold

The silicone mold has a shorter lifetime than an injection mold, and the tool thus created can produce only a few dozen parts.

Expensive as volumes increase

Since silicone mold only can be reused for 15-20 times, as the quantity increase the economics can not be compared with injection molding.

2 >> Design tips for vacuum casting

2.1 Wall thickness

Varied wall thicknesses are allowed but consistency is recommended. We suggest a minimum wall thickness of $>1\text{mm}$.

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2.2 Draft and Undercuts

Draft and Undercuts are not a problem for vacuum casting.

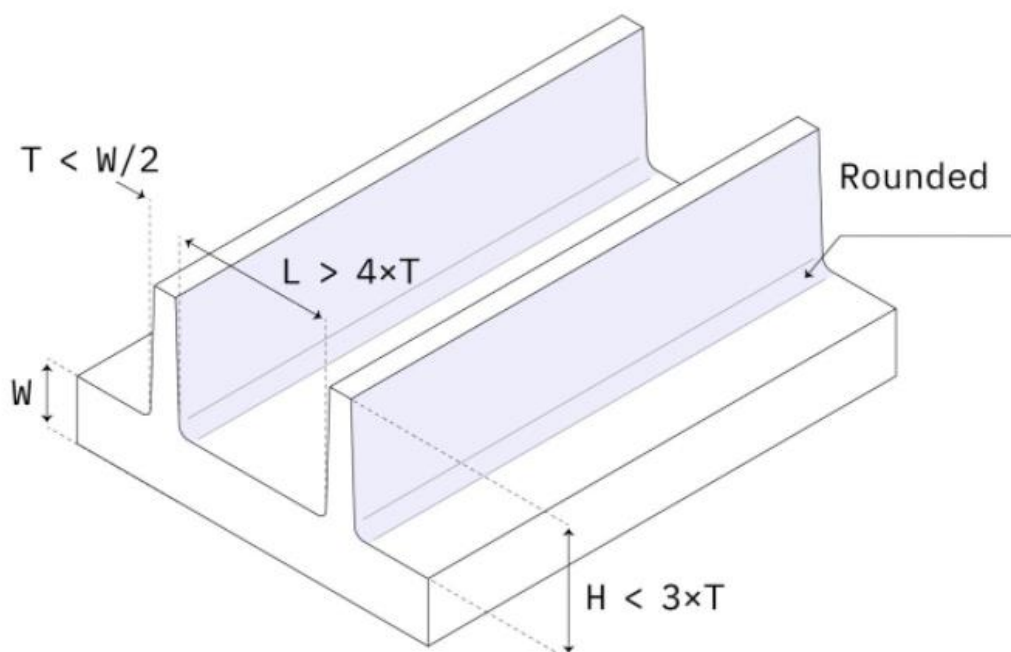
2.3 Ribs

Ribs should have a maximum thickness of 0.5 times the wall thickness to minimize shrink and sinking effects.

Ribs should have a maximum height of 3 times the wall thickness.

Ribs should have rounded edges to help avoid sink marks.

It is better to use multiple ribs to increase bending stiffness than to use one very tall rib, adding a min. distance between ribs and walls of $4 \times$ rib thickness



2.4 Bosses

Bosses are used to facilitate the registration of mating parts, for attaching fasteners such as screws, or for accepting threaded inserts.

Wall thicknesses for bosses should be less than 60 percent of the nominal wall to minimize sinking. However, if the boss is not in a visible area, the wall thickness can be increased to allow for increased stresses imposed by micro-welded inserts or self-tapping screws.

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The base radius should be a minimum of 0.25 X thickness. Bosses can be strengthened by incorporating gussets at the base or by using connecting ribs attaching to nearby walls.

2.5 Radii and Fillets

A fillet radius of 0.125" is recommended on inside corners to increase strength. The inner corners of bosses can use 0.060" radii to help reduce wall thickness. Use these radii whenever you make transitions between surfaces. Radii are important because rigid urethanes are notch sensitive materials.

2.6 Text and logos

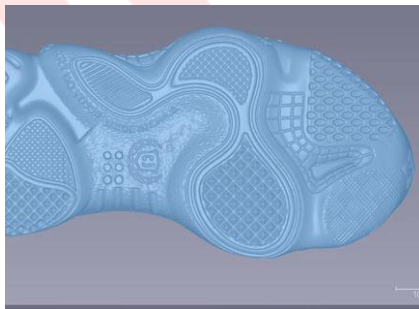
Recessed or embossed text should be $\geq 1\text{mm}$ wide and deep/high and for best result with a 1mm gap between letters.

3 >> Materials

Vacuum casting is mainly used for producing plastics, the materials including ABS, PC, PP, NYLON and TPU/PU/Rubber.

Please click [HERE](#) to view the technical data-sheet of these materials.

4 >> About IN3DTEC Our services



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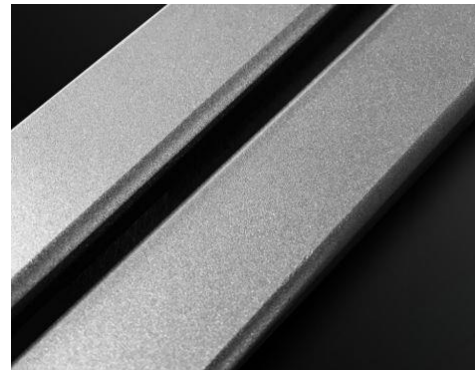
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Thank you very much for taking the time to read this manual, and we welcome your comments or suggestions.

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IN3DTEC

Bring your concept into reality

IN3DTEC was established in 2014 by a professional team in Shanghai with branches in Hong Kong, Suzhou, Shenzhen. We provide a full spectrum of technologies including 3D scanning, 3D printing, CNC machining, Vacuum Casting, Injection Molding and more manufacturing services, which enable us to become a one-stop station from prototyping to on-demand production.

In order to meet different market needs, we expand our offerings to service Aerospace, Automotive, Education, Electricals, Jigs & Fixtures, Medical, Oil & Gas, Transportation.

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