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# VACUUM CASTING

## Understanding the process - a guide for customers

# THE VACUUM CASTING PROCESS EXPLAINED

Vacuum casting is a method to produce parts from a silicone tool (flexible). The silicone tool has a limited life which depends on two main factors (see 'Life of a Silicone Tool' section).

The parts are moulded in a Polyurethane (PU) material. Vacuum casting PU materials are engineered to have similar properties to Polymers that would be used in the injection moulding process. Whilst the range of materials is broad, PU's do not cover the same breadth of mechanical properties that Polymers do. However, most technical requirements are covered to enable a good prototype test requirement or a low volume production run.

Given the nature of production, dimensional accuracy is not to the same standard as injection moulding would be. General tolerances are applied of ±0.1mm.

## MANAGING EXPECTATIONS

Vacuum casting is a process that makes parts from a rubber tool and is a manual process, if multiple tools are required to fulfill the order then part quality can vary from tool to tool. The end user should be aware that variations are part of the process and will accept these variations.

## COLOURS

Some PU resins are clear, therefore we can add a pigment to match a required colour. Some resins are a straw colour and do not take to colours too well, although we can get close if a dark colour is required. If you require an exact (±5%) colour match then we can send a sample swatch (supplied by you) to our colourist with a batch of resin for a pigment to be made.

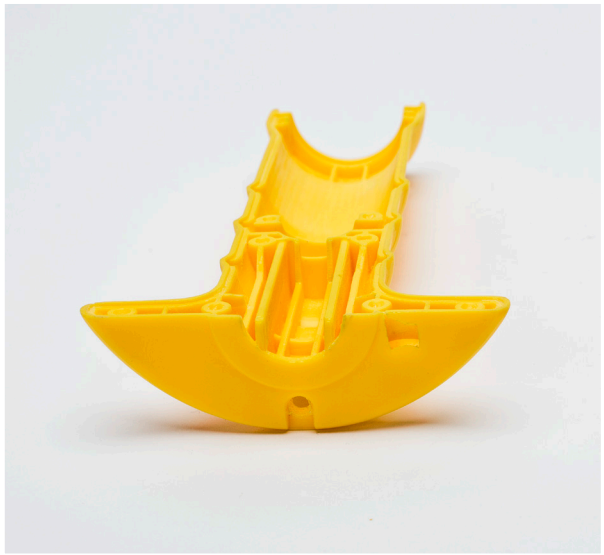
## WHAT HAPPENS NEXT?

1. Client sends 3D CAD file - step file (.step or .stp)
2. Import and verify 3D file. Feedback concession requests
3. Quote and advise lead time
4. Receive order
5. Client confirms they have understood the process detailed over the following pages
6. Acknowledge order and confirm delivery date (may be split deliveries)
7. Print Master Pattern
8. Master Pattern progresses through model shop, surface finish applied
9. Silicone tooling set up
10. Tool trial
11. 1st off inspection - by client
12. Production starts after 1st off approval
13. Delivery at agreed times

# SEEN SURFACES AND TECHNICAL SURFACES

## SEEN SURFACE - A SURFACE

- Blemish free
- No air pockets
- Split line* maybe visible if geometry requires splitting on “A” Surface



## TECHNICAL SURFACE - B SURFACE

- Non visible surfaces may have small air pockets or blemishes caused during the moulding process
- Master Pattern print build lines may be visible
- Design concessions may be required to aid moulding process and to extend tool life
- Inserts can be moulded in

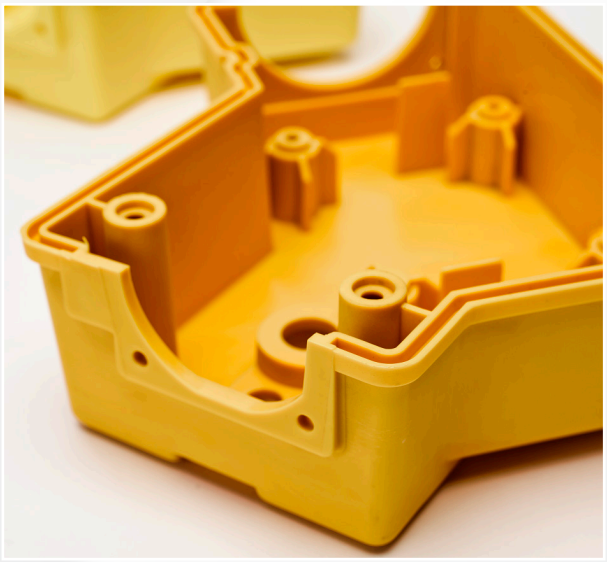
*a split line is the term given to where the mould will split on the part. A line will show on the part unless there is a defined and obvious split on the geometry.

# LIFE OF A SILICONE TOOL

The life of a silicone tool will depend on two factors: **part geometry** and the **material** used to make the part. We will advise what we believe the tool life will be, but this will be a guide.

## PART GEOMETRY

- If a part is simple, has an easy split line and does not have many features on the technical surface then the life will be around 20-25 parts
- If the part has a lot of technical features then the life may be 15-20 parts. The technical features may be:
  - Deep ribs
  - Deep screw bosses
  - No draft/draw angle
  - Clip features



Example of a part with high technical features


Example of a part with low technical features

# MATERIAL

- General materials used will result in 20-25 parts from a tool, subject to part geometry as noted on the previous page
- Flexible materials ('A' Shore range) used, will generally yield a higher number from the tool, this can be around 30
- Specialist materials will yield far fewer parts from a silicone tool, these may be as few as five parts
  - High temperature resistance
  - Fire retardant
  - Filled materials
  - UV Stable

Fire Retardant PU Resin (UL94-V0)

Mixing of PU Resin

Flexible PU Resin

# VACUUM CASTING SUMMARY

**Tool life** – number of parts per impression/tool depends on complexity of the geometry and the PU material used.

**Aggressive materials** – effects on tool life – flexible materials like rubbers and Polyprop mimics lead to extended life, rigid/hard and high temp materials drastically reduce tool life (in general).

**Undercuts** may reduce tool life.

**Wall thickness** - there is no need for uniform wall thickness in our process, remove lightening features designed for injection moulding as we do not suffer with shrinkage and this will improve tool life.

**Split lines** on part – especially where visible on show faces.

**Build lines** - these may still be visible inside cavities.

**Threaded inserts** - mould in threaded inserts possible.

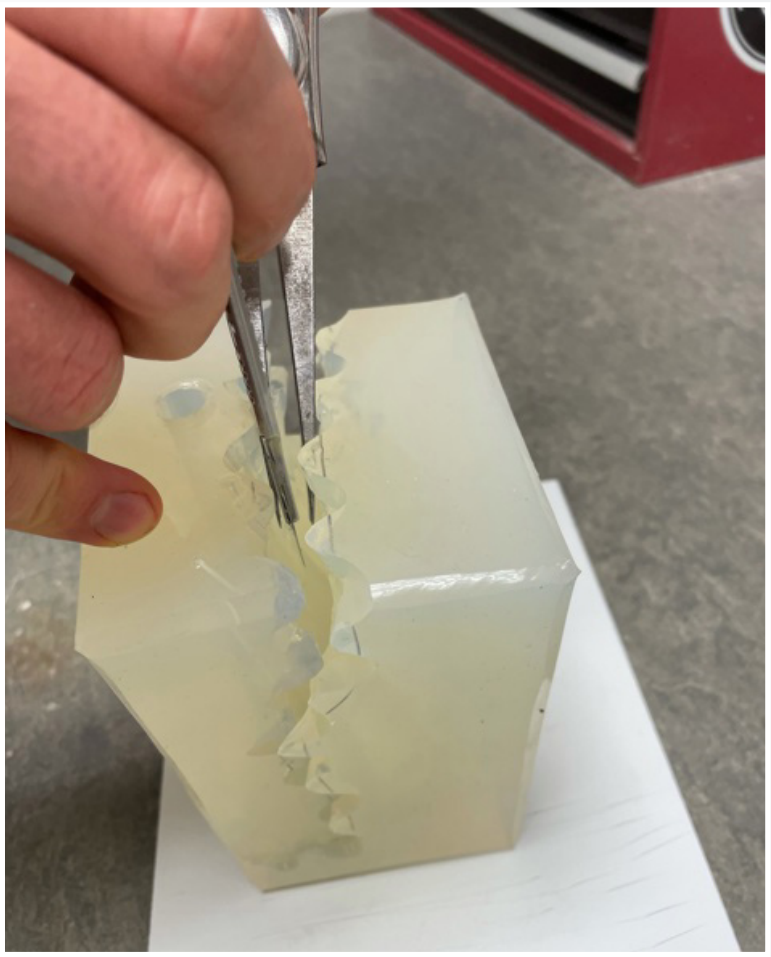
**Overmolding** - this is possible but means two tools/masters. One for the rigid (substrate) and one for the soft.

**Tolerance** on cast parts - general ±0.1. Finer tolerances can be met with the aid of fixtures and post-operative machining.

**Tool storage** – we keep tools for a maximum of three months. If you require them to be stored for longer, please let us know.

**Finishes** available on SLA masters:

- Gloss
- Satin
- Matt
- Textured



## TALK TO US

We have tried to make this guide as comprehensive as possible, however, it is important to understand that every product is unique and, to ensure the best results, each part is analysed on an individual basis.

Our team of experts use their extensive knowledge to determine the best way to build something. We very much welcome you to talk to us to discuss your needs at any point in your product development cycle to ensure you get the best results from your vacuum cast part.

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## ABOUT US

Prototype Projects, established in 1980, is a specialist in the manufacture of prototypes. Located in Royston, Hertfordshire, we are experienced in 3D Printing, CNC Machining, Rapid Prototyping, Model Making and Additive Manufacturing.

As a leading prototyping company we provide a completely integrated design-to-production service including, model making, rapid prototyping, additive prototyping, subtractive prototyping, finishing and additive manufacturing of production parts.

Our in-house services include:

- Additive Prototyping (SLA, SLS, Polyjet, DLP, PμSL)
- Subtractive Prototyping (CNC Machining)
- Vacuum Casting
- Model Making

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