

Urethane Casting & Tooling Technical Reference Guide

The Paramount Process:

The urethane casting process frequently begins with a stereolithography (SLA) rapid prototype master pattern. Machined and/or fabricated master patterns can also be used. The SLA RP model is inspected for accuracy then the "appearance" surfaces are bead blasted, sanded smooth, then a primer coat is applied to achieve the surface finish required to meet your application requirements. If the urethane parts are to be polished or cast in clear resin then the surface will be polished to a gloss finish in preparation to making the SRM (silicone rubber mold).

Next we begin creating the SRM. The silicone rubber uses a room temperature vulcanization process typically referred to as RTV. Your part is carefully scrutinized by one of our technicians to determine the best molding setup to achieve the highest quality urethane casting reproduction. Parting lines are selected to assure best location thus avoiding flash on appearance surfaces. Rubber mold runners, gates, sprues and vents are located in areas to optimize mold fill, isolate and minimize air bubbles to non-critical areas, and optimize appearance surface quality.

After inspection the SLA master pattern is set-up on a parting block to make a two (or many) part mold or suspended in a frame to make a one-part cut mold. Silicone is poured around the SLA master pattern to create the mold. After the silicone is fully cured, the master pattern is removed. The mold is reassembled, whereupon the urethane material is poured into the SRM to create the cast urethane part.

Three casting manufacturing processes are commonly used: pressure casting, LIM (liquid injection molding) and vacuum casting. Process selection is based on casting resin requirements, quantity of castings, part geometry, part size, custom cast-in color specification, threaded inserts, over-molding, etc.

Inspection Procedure:

A four level inspection matrix is used at Paramount. Level 3 is applied to inspect the SLA or machined master pattern. If customer supplies 2D drawings Level 2 will be applied. Level 3 standard includes the following inspection criteria:

- Visual inspection of overall quality.
- Dimensional → 3-6 points randomly selected. The 3D solid model is used to select inspection measurement points.
- Material certification → If requested
- Certificate of Compliance → If requested
- Inspection Report → If requested

Dimensional Accuracy:

In each step of the casting tooling and production process dimensional accuracy is a relevant and ever present consideration. Beginning with the customer's part geometry during Paramount's RFQ process our technical and estimating specialists perform a DFM (design for manufacturing) review. We compare against good injection molding design practices. In our collective years of experience thermo-plastic injection molding design guidelines can be a real indicator of cast urethane part quality. In our process Paramount minimizes shrinkage by using ambient temperature cured materials whenever possible. When not feasible due to casting process and/or casting resin selection, compensating shrinkage is applied to the master pattern. If the customer's stated tolerances are not achievable as-cast, additional material stock can be added for machining.

Customer cast urethane part application (fit and/or function) may require more stringent tolerances. We encourage you to discuss your application requirements with Paramount's technical specialist when submitting your RFQ. This will insure our quoted price and manufacturing lead times consider all your needs. Stated lead times are always from first available start date, after receipt of order.

RP SLA Master Tolerance:

Additive layer manufacturing (rapid prototyping) may require additional considerations for production tolerance. Cause may be due to customer STL file preparation, SLA pattern warpage and surface finish. The SLA epoxy resin can absorb moisture which may affect part dimensional accuracy. Every effort is made to mitigate moisture absorption by coating the master.

- .000 to 1.00 +/- .008 inch overall
- 1.00 to 3.00 +/- .010 inch
- 3.00 to 6.00 +/- .012 inch
- 6.00 to 12.0 +/- .015 inch
- Add +/- .0015 /inch over 12.0"

SRM Tooling and Casting Tolerance:

- .000 to 1.00 +/- .005 inch
- 1.00 to 3.00 +/- .010 inch
- 3.00 to 6.00 +/- .012 inch
- 6.00 to 12.0 +/- .020 inch
- Add +/- .002 /inch over 12.0"

Tighter tolerances are attainable. Please consult Paramount's technical specialist to your exact prototype or production application requirements. Silicone rubber molds have a finite shelf life of 3 months. Tolerance reproducibility may not be achievable beyond this time. Certain urethane resins can reduce mold life and part yield.

Customer satisfaction, on time deliveries, zero defects and zero returns are Paramount's number one goals.

For more information about Paramount's Quality Management Standards email: quality@paramountpds.com