SPECTRUM PLASTICS™ GROUP

Technical Paper

Why Choose RTV Molding?

RTV Rubber Molding and Urethane Casting

Overview:

The process of silicone RTV (Room Temperature Vulcanization) molding (a.k.a. urethane casting), also considered as a rapid tooling method, has been utilized for years to fill the gap between the stages of prototyping and metal tooling. RTV molding is an efficient and inexpensive way to produce small quantities of prototypes or production parts for form and fit testing, certain functional testing, marketing samples, and for some parts pre-production and/or low volume production. RTV molding produces strong parts that have properties similar to thermo plastics and have the look and feel of an injection molded part. The options include both rigid (shore D) and flex (shore A) durometer urethanes. RTV molding captures remarkable detail due to the flexibility of the silicone.

The yield of a RTV mold depends, primarily, on which type of silicone is used to make it. The process is typically used to produce 1 to 35 parts, but this number can go much higher utilizing multiple molds. The criteria for choosing the type of silicone is based on the particular project, such as required lead time, number of parts needed, type of urethane being cast in it, surface finish and the geometry of the part.

Typically your parts are produced within 5 to 7 days after an order has been placed. Once the tool is ready and parts have started to be cast a few parts per day can be made (pulled) from the mold. The number of pulls per day can vary depending on the urethane used and geometry of a part.

Options Are Plentiful

With RTV casting, options are plentiful regarding materials, color, texture, inserts and over-molding.

Materials

Materials that can be cast in a rubber mold are two-part polyurethanes, silicone rubber or wax. A prototype material can be selected to mimic the hardness of the production material, anywhere from 10 shore A to 85 shore D.

Color

Parts can be painted to your exact specifications, and matched to a Pantone® number or color chip. As an alternative to painting, colors can also be matched by adding color to the resin and cast right into your parts.

Texture

The mold will pick up the texture of the master pattern when created, directly transferred into the mold cavity. Different textures can be added for cosmetic purposes.

Inserts

To facilitate assembly, threaded inserts can be incorporated into your parts. Pins or wires can also be cast directly into the part.

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Simple Process

Step 1 - Creating Master Pattern

The first step involves making a master pattern from your CAD file (in some cases the file is scaled to compensate for mold shrinkage). The pattern is generally made from an SLA part but in some cases a Polyjet™ or machined part can be used. If the customer has an existing part this sometimes can be used for the pattern. The pattern is then finished to the required specifications to achieve the desired surface (such as gloss or matte).

Step 2 - Making the Mold

The master is then suspended in a frame or box and liquid silicone is poured around the pattern and allowed to cure. After the silicone has cured the mold is split in half and the pattern removed.

Step 3 - A Urethane Part Casting is Performed

A urethane is chosen (that best matches the mechanical properties desired) and injected into the mold. After the urethane has hardened the part is removed and goes to final clean up. It then is ready for delivery.

Over molding (or 2-shot)

Two patterns and molds are created, one without the over-mold and one with the over-mold. Once the part without the over-mold is cast, it is inserted into the mold for the over-mold. Resin is added to create the over-mold on the existing cast part. Once the part is pulled, it has both materials cast to complete the two-step over-mold process.

RTV Rubber Mold and Urethane Cast Part.

Design Tips to Extend the Life of Your Mold

While RTV molding is a great solution in many applications, without a doubt the greatest obstacle to high cast part volumes is the limited life of the silicone tool. Most RTV molds are good for about 10 -35 parts. This number varies depending on the silicone used in the mold and urethane material used for the part, surface finish, and the geometry of the part being molded. For example, a polished rigid (shore D) part will have a lower mold life than a textured (shore A) part. Assuming a higher number of parts per mold is desired, here are some design tips and rules of thumb for higher mold life. Please keep in mind that this relates specifically to RTV molding not injection molding or LSR molding.

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1:1 Aspect ratio

By keeping features as wide as they are deep, the features are more stable, and consequently the silicone that forms those features will be more stable as well. This is particularly true with raised or recessed text, also channels that surround the edge of a part in a "tongue and groove" feature. A groove that's .050" wide, but .100" deep will not last as long as a groove that's .050" wide and .050" deep, nor will it last as long as a groove .100" wide and .100" deep. Keeping features such as this as close to 1:1 as possible will help the feature remain intact after several de-mold cycles, which will lead to improved mold life.

Undercuts

It's true, that one can get away with omitting draft angles, even molding undercuts with silicone tooling. Even so, undercuts do put a tremendous strain on the silicone during the de-mold cycle, which can stretch, even tear the silicone. If an undercut is absolutely necessary, try to provide ample room opposite the undercut feature, so the trapped silicone has somewhere to go when the part is being de-molded.

Thin Floors

Just because a wall or floor can conceivably be built with Stereolithography, doesn't mean it's a great candidate for RTV molding. For instance, floors thinner than .030" will be more problematic because the area can be too thin to allow the material to flow. Floors, which are thinner than .050" won't be structurally supported across larger areas. Remember what's forming that wall is soft silicone that can stretch, bend, and sag with each molding cycle, causing thin areas to become even thinner, or shut off completely. When possible, try to keep your nominal wall thickness close to .080" at a minimum, and keep the webbing of keypads at .030" for optimum silicone mold life.

Fill in the Holes

For good reason, you've designed your part with uniform wall thickness, and for added strength you've included some gussets to keep that corner boss in check. Well, the result is a deep, narrow area in the corner that will lead to reduced silicone mold life. Any time there is an area with an aspect ratio of greater than 1:1 (as mentioned above) it will improve mold life to

Painted Cast Urethane Parts with Artwork Applied

have this deep cored area minimized. This will help increase the life of the mold as much as possible resulting in a good solution. This can be done by the model shop, which is making your RTV mold, and is not an adjustment that you need to do to your CAD file.

RTV Molding Benefits

The previous information has heightened your knowledge about the RTV casting process and offered tips on tweaking your design to be more successful with RTV molding. Here are some additional benefits to choosing RTV molding over other processes:

Low Tooling Investment

As a general rule, RTV molds typically cost between one fifth and one half of a prototype injection mold for the same part. So a $10,000 aluminum tool would be closer to $2K in silicone. This makes RTV molding a great option when the quantities of the parts needed are relatively low, and simply comparing the cost of the tool plus the cost of the parts from each competing process can show, in many cases, the total cost RTV molding is quite a bit less.

More Design Freedom

Since the tools are soft, and the molding process is not automated, one can get away with pushing the limits of what can be molded a little further using RTV molds. For example a cable over mold assembly with three different cables would add a significant amount of cost and complexity to a steel tool, while in silicone the added complexity is much less significant and considerably less costly.

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Ease of Design Change

Even on production quantity projects, the cost to change something when done with RTV molds is always considerably less than it would be to modify a steel or aluminum tool. For example, you need to add or move a screw boss, or change a logo, or modify any other feature, those changes can get introduced into production and incorporated into the new silicone molds, quickly and economically, often with little disruption to the production flow.

Lower Risk

RTV molding allows OEMs and designers to start with a lower production investment and smaller quantities, initially, then commit to injection molding later on when justified. This extra time allows you to gain some confidence in the design and commercial or consumer demand for the product before committing to the expense of production steel tooling.

Ease of Experimentation

While it is possible to experiment with different materials and/or colors once you've made injection molds, the process is much simpler with RTV molding. For example, several different durometers of rubber-like materials can all be poured into the same mold one after another. Also parts of varying color can be poured using the same mold, which can be an advantage over painting.

Click here with questions or comments about RTV

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Conclusion

RTV Rubber Molding is an inexpensive, accurate, and fast way to create anywhere from a few dozen duplicate prototypes to a few hundred production parts.This application can be a great alternative when time or money won't allow for the production of a steel tool and injection molding. It's also practical when bridge tooling is needed while production tools are in process.

Technical Paper

The development of this technical paper is to give a more in-depth look at the RTV rubber molding/urethane casting process and educate customers for the purpose of making better informed decisions, resulting in a better finished product and more cost effective operation.

The information is provided by Spectrum Plastics Group and its Divisions, Dynacept and Protogenic. The project was not funded by any materials manufacturer.

***Spectrum Plastics Group,** headquartered in Minneapolis, MN, consists of 2 separate manufacturing facilities to better service customers in the following markets: Medical, Defense, Industrial, Aerospace,and Electronics.*

***Spectrum Plastics Group** offers injection molding and contract manufacturing facilities in the following locations: Minneapolis, MN, and Ansonia, CT.*

***Divisions of Spectrum Plastics Group, Protogenic,** located in Westminster, CO, and **Dynacept,** located in Brewster, NY, are professional service bureaus specializing in Rapid Prototyping Technologies. Both facilities manufacture prototypes and conceptual models using stereolithography (SLA) and Laser Sintering of nylon (LS), silicone rubber (RTV) molds and cast polyurethane parts for limited quantities.*

For more information, please email: sales@hq.spectrumplasticsgroup.com

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