Ensuring Success With a Rubber Molding Partner via the 3 Ds

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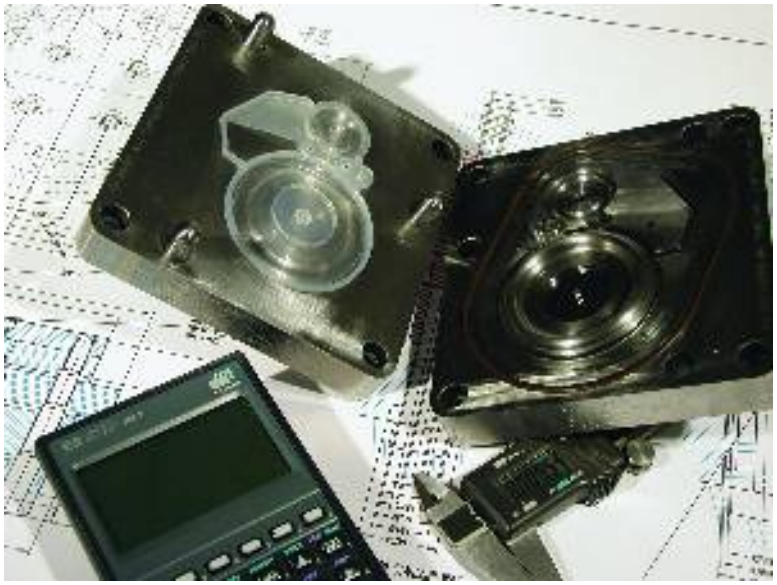
“The molding process is most effective when the designer and the molding company work closely from the beginning of the design process all the way to first article. Many molding concerns can be addressed at the design phase. It takes a team of experts, including chemist, quality specialist, and engineers, to create the most effective methods for molding.” –Robert Ballard, engineering manager, Da/Pro Rubber



Precision tooling

Keeping in mind the critical factors of the three Ds–design, drawing, and development–will significantly improve the successful fabrication of a rubber medical device component.

Design

The design of the component can contribute to whether or not it can be molded effectively and efficiently. If the molding process is considered from the “drawing board,” the process of working with a molding partner becomes more cost efficient and the component is delivered more effectively.

Consideration of the molding process during the design phase allows the rubber manufacture to achieve effective tooling design. The designer should consider:

- Relative Dimensions
    - Concentricity–Diameters formed in the same mold plate will be concentric within 0.0254 mm, other diameters 0.075 mm.
    - Squareness–The quality of being at an angle of 90°, such as “surface must be square with axis.” Rubber surfaces that are not ground should be allowed a 2° tolerance.
    - Flatness–Molded surfaces will be flat within 0.2 mm.
    - Parallelism–Relationship of surfaces in different planes
    - Remember that rubber parts are, by design, flexible. As such, certain dimensions may have to be measured in tool steel as verification and reference dimensions used on the rubber part itself.
- Flash Considerations
    - Note surfaces that cannot contain parting lines.
    - Designate surfaces that will allow parting lines and the allowable flash that will not impair product function or appearance. Da/Pro [1] standard is 0.002 × 0.01 in. extension. (Secondary process can improve on standard.)
- Insert Usage
    - Consider durability of bond needed.
    - Insert tolerancing can affect the ability of a final part to meet print, or the ability to mold the part.
    - Design limitations
    - Avoid localized stress raising irregularities.
    - Minimize edge effects.
    - Minimize surface roughness.
    - Avoid welding a molded rubber component.
- Sharp Corners–90° angles can cause tears as the parts are removed from the mold. The exception would be the parting line itself. Radii should be as generous as the design will allow.
- Multi-Cavity Tools–It is helpful to allow an area on the part designed to include cavitation id. This allows the molder to identify variations by cavity within the tool.
- Material Choice–Should be conducive to the application but flexible enough to allow the molding partner to give input on best recommendations.
- Material Considerations
    - Availability of material
    - Cost of material
    - Method recommended for molding
    - Properties of materials
    - Part environment

Drawing

When providing a drawing to a molding partner, the information included on the drawing is essential in determining the moldability of the part. Elements that should

be present include:

- Detailed dimensions
- Material specifications
- Allowable tolerances, including CpK requirements
- Finish designation
- Flash allowance
- Insert dimensions
- Include any specification documents that are called out on the drawing.
- 3D models are helpful to the molding engineer to help recommend design changes that make the component mold more efficiently. This geometry can be used directly for mold design to ensure the part matches the original design intent.
- Note critical to function areas.

Development

The molding partner will suggest the methodology for manufacturing the part that is most effective and cost efficient for the component. Some factors in determining the method of molding–liquid injection molding, compression molding, or transfer molding–are the quantity of production parts expected, the design of the part, and the material used.

- Measurement methodology–Make sure the molding partner is aware of any special measurements that will be made to the finished product. Establish Gage R&R requirements.
- Since rubber is elastic, it is more effective to do a functional test rather than measure the part.
- Allow enough time for tooling to be manufactured. Factors affecting the time line for tooling include:
    - With a very tight tolerance part that has a complicated design, tooling is essential for the efficient manufacture of the part. Precision tools take longer to manufacture.
    - With a high volume part that requires more cavities to make the part, the tool build will take longer than a low cavity tool.
    - First articles manufactured off a new tool are delivered to verify that the parts are acceptable. It is advised to confirm or reject these as soon as possible so modifications that are needed can be made quickly to ensure delivery of prototypes or production parts by the designated delivery date.
- Review specifications provided by the molding partner during the quoting process.

Reference

RMA. (1970). RMA Handbook. New York: RMA.

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