

ProMed Examines How Smaller Component Geometry Affects Micro Silicone Molding

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A silicone component doesn't become difficult to manufacture based on size alone. The greater challenge may come from a membrane that must fill without tearing, a sealing edge with little tolerance for flash, or a narrow lumen that must remain open after molding. In micro silicone molding, these functional details shape the material, tooling, process, inspection, and scale-up decisions that follow.

The drawing is the practical starting point. Engineering teams need to identify which dimensions and surfaces control device function before selecting a mold design or production method. A low-mass part with straightforward geometry may present a different manufacturing problem than a larger part containing thin walls, microchannels, fine ribs, or small holes. The critical feature, rather than the outside dimensions, often determines the required level of process control. That distinction guides ProMed's design-for-manufacturability review before tooling begins.

Once those features are defined, the focus moves to filling the cavity. Liquid silicone rubber can flow into fine details, but low viscosity also leaves little room for error at parting lines and vents. Gate location affects how material reaches thin or distant areas, while vent design must release air without creating a path for excessive flash. Runner balance, cavity alignment, steel condition, and surface finish become increasingly important when a minor variation can alter a functional edge or block a small passage.

Material flow and cure also have to be developed together. Thin sections and low part mass respond quickly to mold temperature, yet cure chemistry, material delivery, residence time, and local heat transfer still influence the usable process window. Material that begins curing before the cavity fills can leave an incomplete feature. Insufficient cure can create a different problem by making the part harder to release or handle without distortion, or it could require a post-curing step.

The same geometry that complicates filling can make demolding difficult. Soft silicone may stretch around an undercut, cling to a polished surface, or fold as a delicate part is removed. Tool access, draft, parting-line placement, and ejection strategy, therefore, need attention before the design is released. A component that

can be removed successfully during a small prototype run may still require changes before repeatable production, especially when manual handling or flash trimming would be difficult to control.

Once the component leaves the mold, the manufacturing question changes from forming the feature to confirming that the feature meets its requirements. A contact probe can deform soft silicone, while translucent material or hidden internal geometry can limit conventional optical inspection. Fixture design, lighting, magnification, measurement force, and part conditioning can all change the reported result. Depending on the component, optical 2D inspection, computed tomography, tactile CMM measurement, or chromatic white-light inspection may help evaluate critical geometry. The selected method must be repeatable enough to support the acceptance criteria and validation plan.

Handling, assembly, and packaging create another set of practical concerns. Small silicone components can stick together, attract contaminants, become difficult to orient, or deform in bulk packaging. Assembly fixtures, protective trays, controlled quantities, and automated handling may be appropriate depending on the geometry and volume. Packaging decisions also need to account for compression, storage, traceability, and transfer into the next manufacturing step.

These decisions become more consequential during scale-up. A prototype can demonstrate that a part is moldable, but production readiness also depends on a documented process window, defined handling methods, stable tooling, appropriate inspection, and controls suited to the intended volume. Higher cavitation, equipment transfer, secondary operations, or material changes can affect flow, cure, release, and measurement. Development records should capture those relationships so later changes can be evaluated against the established process.

As a family-owned, privately held contract manufacturing and development partner, ProMed supports regulated programs involving complex silicone and plastic components, assemblies, molded desiccants, and polymer-based dosage forms. For micro silicone molding, that work can include design-for-manufacturability review, in-house tooling, process development, metrology, testing, assembly, packaging, and documentation support from prototype through production.

Smaller geometry narrows the margin for variation across each manufacturing step. Connecting component function to tooling, molding, handling, inspection, and validation planning can help establish a process that remains practical as production requirements develop.

About ProMed:

Since 1989, ProMed has been recognized as a leading Contract Manufacturer of complex, intricately

designed molded silicone and plastic components and assemblies for highly regulated industries. ProMed's expertise extends across applications for short-term and long-term implantable devices, single use devices, drug-releasing combination devices, and specialized materials and processes for defense applications. The company collaboratively works with customers from prototype through production, providing over 30 years of experience related to design for manufacturability, material selection, tool and fixture design, process development, manufacturing, and other value-added services that result in cost-effective solutions with superior quality.

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