Apple Rubber

CASE STUDY

Transitioning from Single Cavity Design to Multi-Cavity Tooling

The Problem

Starting a new part design, making sure it works and integrating it into production.

The Solution

Apple Rubber works with customers from the initial design phase – from single cavity or prototype stage to transition into a multi-cavity production tool – with full process validation.

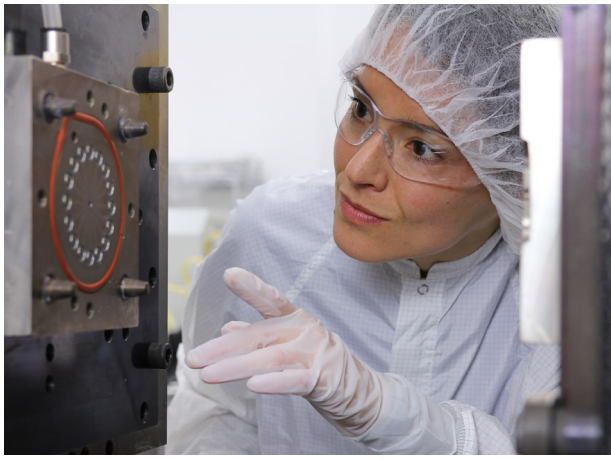
Apple Rubber is proud to have an extensive staff of expert Design Engineers. Our engineers are versatile, assisting with a variety of applications including:

- Part design
- Aid in modifications to assure robust performance
- Provide seamless full-scale production assembly

Our customer came to us with a standard o-ring design. With engineers' assistance and our O-Ring Gland Calculator at applerubber.com, we assured the customer that their o-ring had the correct compression. We looked at both concentric and eccentric conditions to do a tolerance stack up. These ensure that, regardless of whether the design was shifted in the application, the correct compression will be maintained on the o-ring to assure sealing.

Through this process, one problem that we identified was the gland volume was less than the volume of the o-ring. This caused higher compression and potential leak paths. We recommended at least an 85% volume fill to avoid failure.

O-Ring Function Test



Our customer then received all of the mating components for functional testing. With our in-house tool making, we are able to make a single cavity tool with high-precision to match certain dimensions and tolerances. We noticed that other components were out of specification, so this caused our o-ring to fail in the applications. Using the O-Ring Gland Calculator again, we were able to assist our customer in changing the o-ring to meet their design with actual dimensions of the mating metal and plastic components.

O-Ring tooling is typically cheaper than changing plastic tooling. With the new o-ring, our customer was able to function test the new design, and verify that it passed. Knowing our customer was using the o-ring for a disposable application, we knew automation assembly was going to be very important. Many assemblers use vibratory bowl feeds to try and feed silicone o-rings. This causes the silicone material to produce static electricity as it is vibrated, which means the o-rings will stick together. Therefore, for the prototype tooling, we added a blast bead surface to help rough the finished surface of the o-ring.

We also provided a coated o-ring to test. Testing this early in the design phase helps with a later phase of biocompatibility testing, because more changes will not have to be made then, which would slow the rest of the process.

Integrating Into Production

With the higher durometer, the bead surface was all that was required to feed the automation equipment. Now that we reached the production stage, we designed a multi-cavity tool to fulfill the customer's current projections and 10-year projection. We completed the production tooling by providing a full process validation IQ OQ PQ. Installation qualification (IQ) was completed on the equipment that was being used to run the mold. Operational Qualification (OQ) was run varying the major processing factors. Runs were done at the high and low limits of all identified machine settings. Performance qualification (PQ) was completed by measuring all o-rings to look at CPK and PPK. Once qualified, we are able to provide millions of o-rings to our customer.

About Apple Rubber

For over 45 years, Apple Rubber has set the standard for quality, high-performing rubber o-rings. Today, as the leading designer and manufacturer of seals and sealing devices, Apple Rubber serves a wide range of industries around the world, from automotive and aerospace to pharmaceutical and medical. We offer the sealing industry's broadest range of products with an unparalleled range of in-house capabilities and services out of our Lancaster, NY facility.

Learn more about Apple Rubber's capabilities by visiting applerubber.com or armedicalseal.com for more information about medical seals.