

Particle-filled silicones for EMI gaskets for defense touchscreens

This article explains why a custom component manufacturer selected a nickel-coated, graphite-filled silicone to produce EMI gaskets for a touchscreen integrator. It examines all of the application requirements (including cost) and describes the gasket manufacturing process. The article also discusses design and production challenges, and how overcoming them enabled the integrator to win its DOD bid.

Introduction

Stockwell Elastomerics is a custom component manufacturer that serves niche markets in aerospace, defense, telecommunications, and other technology-based industries. Located in Philadelphia, Pennsylvania, the company manufactures custom components to OEM specifications using its full range of capabilities. Processes include die-cutting, water jet cutting, silicone injection molding, compression molding, custom assemblies and adhesive lamination onto silicone rubber and other high performance materials.

The customers who benefit most from Stockwell's capabilities are manufacturers that utilize design innovation as part of their strategy. So when a touchscreen integrator needed a custom EMI gasket for a defense contract, they turned to Stockwell Elastomerics for a solution. The EMI gasket had to attenuate electronic emissions, seal the units from harsh environmental conditions, and offer cushioning for mechanical shock – all while meeting a competitive price point.

Understanding the application

Stockwell needed to select an EMI gasket material that could withstand a wide range of physical demands. The touch screen unit would be deployed globally in rugged environments. The gasket needed to seal under the extremes of desert heat or arctic freeze, keeping out dust, rain, and water during wash-down. In addition to sealing, the customer wanted the gasket to offer some cushioning to help protect the unit from mechanical shock and be soft enough to avoid distorting or interfering with the touch function of the display. Finally, the gasket needed to attenuate EMI emissions.

Other requirements for this touch screen EMI gasket were that it needed an adhesive backing and had to meet a specific price point. The adhesive was needed to keep the gasket in place during installation and product refurbishment. It also had to be electrically conductive to maintain the Z-axis conductivity. Lastly, the entire gasket configuration needed to be priced competitively since the custom touchscreen assembly was headed into a bidding process for a defense contract.

Choosing the right EMI material

Stockwell Elastomerics looked to Specialty Silicone Products (SSP Inc.), a Ballston Spa, New York supplier with a deep history in silicone rubber technology, for a unique silicone compound that would address all of the application requirements. As a long-time supplier to Stockwell Elastomerics, SSP understood Stockwell's ability to mold conductive silicone rubber and laminate adhesives – a low durometer (soft), nickel coated, graphite filled silicone could be molded efficiently by Stockwell. The nickel/graphite fill would meet the attenuation requirements and cost restrictions, while the low durometer silicone would meet physical requirements.

SSP's nickel/graphite particle-filled silicones are used in numerous military and commercial EMI applications, and are designed specifically to overcome challenges that are inherent to some Mil Spec materials. Traditional Mil Spec EMI materials, specifically MIL-DTL-83528, are limited to higher cost conductive fills like silver plated copper and silver plated aluminum, and high durometer (hard) rubber materials. SSP's nickel graphite filled silicones offer very good attenuation and lower durometers, which allows engineers more latitude to meet tough design challenges – and within budget.

Silicone is the elastomer of choice for many outdoor gasketing applications due to its thermal stability, low compression set, and resistance to ozone and ultraviolet (UV) light. Silicone rubber can easily withstand desert heat and Arctic cold, and seal against wind-driven rain, heavy wash down or submersion. These properties, in addition to silicone's long life, are critical for products requiring ruggedization. When filled with fine conductive particles, these specialty silicone compounds perform the dual functions of environmental sealing and EMI attenuation.

Stockwell Elastomerics' touch screen application also required an adhesive backing. To meet this, Stockwell chose a 3M product, an X-Y-Z axis conductive pressure-sensitive adhesive, to maintain electrical continuity between the gasket and assembly. The selected adhesive offered very good bond strength to the touchscreen bezel, and the easy-peeling release liner allowed for quick and easy installation, keeping assembly costs down.

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Solving design and manufacturing challenges

Once the materials were selected, the process to manufacture the EMI gaskets needed to be determined. This project had two distinct timelines. The first was the engineering build where gaskets were needed very quickly to meet a deadline for testing. The second challenge was for production parts with high quantities. In order to meet the short engineering build deadline, Stockwell Elastomerics waterjet cut sheets that were laminated with the 3M conductive adhesive. The waterjet cutting process allowed Stockwell to deliver custom cut parts within 2 days and with no tooling costs. Once the functional and EMI testing was completed, production tooling was made. The same nickel/graphite filled silicone compound that was used to make the sheets was used to mold rough blanks for the touch screen gasket. These molded blanks greatly reduced material waste while still allowing for proper adhesive lamination of the narrow wall gasket. The adhesive backed blanks were then cut to the final gasket geometry and tolerances.

This two-step approach allowed the customer to meet its timeline and test parts without any tooling investment. Once testing was complete, Stockwell was able to manufacture the custom EMI gaskets in an efficient manner to hold down labor and material costs. In turn, this provided the customer with a pricing advantage that helped them win the DOD bid with a water-sealed touchscreen that met the EMI attenuation requirements.

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