Bonded EMI O-Rings for Reduced Costs and Improved Performance

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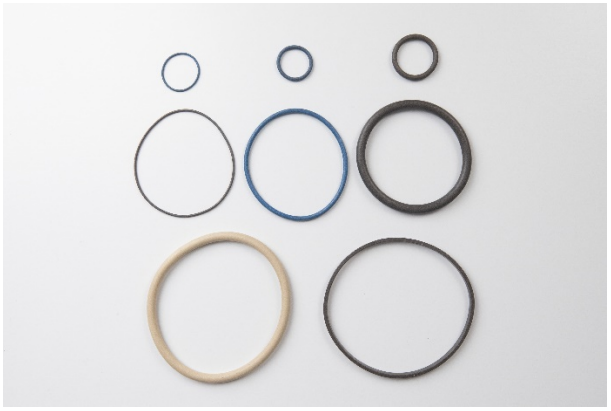
Bonded EMI O-rings need to provide reliable protection against electromagnetic interference (EMI) in medical, military, automotive, aerospace, and other demanding applications. The shielding silicones that are formed into cords or shapes for these donut-shaped parts must also ensure environmental sealing and electrical conductivity.

Selecting the right EMI silicone is important, but so is the choice of a bonding process. Otherwise, bonded EMI O-rings may cost too much or fail to meet performance requirements.

Today, many manufacturers bond EMI O-rings with a non-conductive RTV silicone adhesive that lacks an EMI filler. This makes it possible for radio waves to penetrate the joint and create EMI in the end product. Manufacturers who use a non-conductive, non-silicone adhesive also risk EMI leakage, but that's not the only problem they face.

Non-silicone glues such as acrylics dry to a much harder durometer than the EMI silicone cord itself. This leaves a "hard spot" in the finished gasket. Plus, acrylic adhesives cannot match the temperature range of the EMI cord material. If the bonded O-ring is subjected to very high or very low temperatures, the joint may break easily. This is a significant risk in military, aerospace, and satellite communications.

Molding vs. Bonding



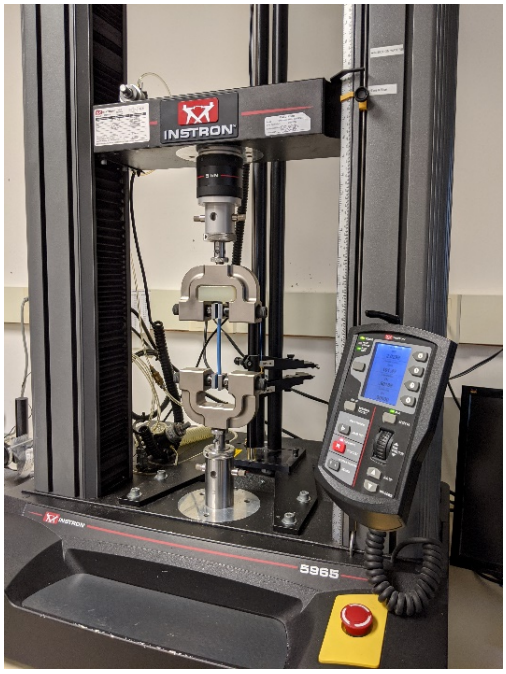
Buyers in all industries want cost-effective parts, but not at the expense of performance. They also want shorter lead times and less risk. Molded EMI O-rings don't require bonding, which reduces the risk of EMI leakage. Yet, there are tradeoffs.

Molding requires tooling that's complex, expensive, and takes longer to produce. If the mold is incorrect, buyers face project delays and cost overruns. Because EMI O-rings are jammed into a tight space, part deformation can result if the actual dimensions are different from those on part drawings.

Bonded EMI O-rings from Specialty Silicone Products (SSP) use tooling that's faster and less expensive to produce. We build the tools and extrude the EMI cords at our ISO 9001:2015 manufacturing facility in Ballston Spa, New York (USA). With our in-house capabilities, we can supply you with more prototypes of bonded EMI O-rings than you'd get if you waited for a single molded one. Whether it's for prototyping or production, our tooling costs are lower and the lead times are faster than with molded parts.

Importantly, the bonding technique that SSP uses is more reliable than other joining methods and enables us to control quality. Our hot splicing method applies heat and pressure to a conductive silicone with a durometer similar to the EMI cord itself. In addition to reducing the risk of EMI leakage, this eliminates the "hard spot" you'll find in other gaskets. Then, because our method uses silicone instead of acrylic, the joint has better temperature resistance for more reliable performance under extreme conditions.

SSP's Bonded EMI O-Ring Project



To demonstrate the advantages of our bonded EMI O-rings, SSP produced vulcanized samples with our tooling and materials. A primary goal was to prove that our products are as good as molded EMI O-rings. During development testing, benchmark and scale-up trials were performed using different EMI cords in various shapes and sizes. During each trial, we visually inspected bonded EMI O-rings for defects. We also measured bond strength and developed length, and then compared the data to standards.

Statistical analysis validated the consistency of production and our adherence to specifications. Multiple quality control (QC) checkpoints were used. At SSP, startup and in-process QC checkpoints ensure that all input materials are properly identified, equipment is operating as expected, and EMI O-rings are within specifications. Bonded EMI O-rings were compared to visual acceptance standards from customers, and a final QC checkpoint occurred after the production of each batch. The Instron tensile tester (above) is some of the equipment we used.

The splicing tool, or mold, that we used to hold O-rings in place was made with our in-house CNC equipment. Because SSP has its own tool room, we can easily customize shapes or cross-sections for customer projects. The original equipment manufacturers (OEMs) who order from us like this flexibility, but they also appreciate the consistent quality of the finished product. When an installer smashes a bonded EMI O-ring into a groove, the part fits and the joint holds.

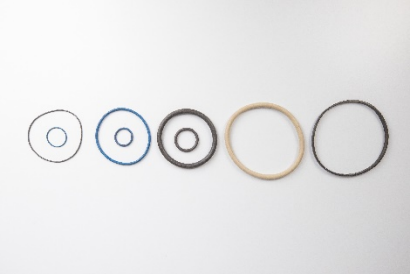
The OEM Example

Consider an example where an OEM orders molded EMI O-rings with a .093 inch cross-section and 4.9 inch diameter. For prototyping purposes, the manufacturer needs a small, one-cavity mold. The lead time is 6 to 8 weeks and the mold costs between $2000 and $3000. Prototypes are molded according to the part drawing, but there's a problem during fit testing because the molded EMI O-rings are too large. The molder made the O-rings to spec, but the measurements were still incorrect.

Next, the OEM orders O-rings with a diameter of 4.7 inches. The new part fits but the total lead time to get a first article is longer because of tooling changes. Even if the original mold can be machined to the part's smaller size, there are additional costs. Then the OEM orders a more expensive production mold. The wait time is another 6 to 8 weeks with an estimated cost between $5,000 and $15,000. Along with months of lost time, this project faces tooling costs as high as $18,000.

If the OEM had ordered bonded EMI O-rings from SSP instead, the benefits would have been significant. For starters, SSP could have shipped samples with diameters of 4.7, 4.8, and 4.9 inches. By using a single hot splice tool instead of larger and smaller molds, we can cut three different lengths before vulcanizing the ends. If the OEM confirmed that 4.7 inch O-ring fit, SSP could have extruded more cord and started making production parts without extended lead times and added tooling expenses.

Bonding EMI O-rings provide a fast, cost-effective alternative to molded ones. Yet, OEMs can't afford to sacrifice performance. Other manufacturers offer bonded O-rings, but some use non-conductive silicone adhesives that risk EMI leakage. Other manufacturers use non-conductive, non-silicone adhesives that leave a hard spot in the gasket and that have a different temperature range than the EMI silicone cord. If you need EMI O-rings that both reduce costs and improve performance, contact Specialty Silicone Products.



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