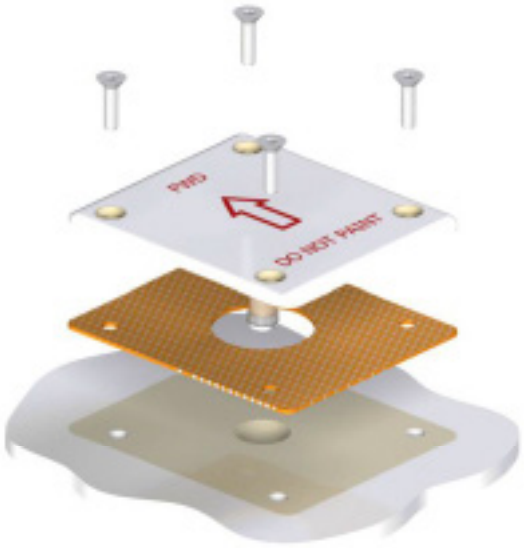
Application Note

Parker Chomerics

Metalastic™ EXP-URE Corrosion Resistant Conductive Antenna Gaskets



Customer Value Proposition:

Parker Chomerics Metalastic EXP-URE urethane filled expanded aluminum aircraft gaskets provide an electrically conductive, fluid and pressure sealing solution for exterior mounted aircraft accessories such as antennas and lighting. Developed to minimize galvanic corrosion of mating surfaces, these fully-cured gaskets are an effective solution for lightning strike grounding and survivability. With numerous performance improvements when compared to alternative sealing solutions, customers can expect a 33% lower total cost of ownership from assembly rework and material replacement avoidance.

Product Description:

With increased customer requirements for corrosion resistant solutions in the aerospace market, Parker Chomerics has leveraged more than 50 years of gasketing development experience to create this innovative material. Taking into consideration numerous performance requirements identified by aerospace customers, this product offers superior electrical and corrosion performance when compared to traditional gasketing solutions. Taking product development one step further, this gasketing material can easily be implemented into existing assemblies without design modifications being required, resulting in reduced integration time and effort.

Material Properties

Typical Properties	Test Procedure	Units	Values
Metal	-	-	3003 Aluminum Alloy
Elastomer	-	-	Translucent Orange Urethane
Electrical Thru-Resistance	ASTM D575	Ohms	.0015
Shielding Effectiveness*	CHO TP09**	dB	>90***
Corrosion Resistance*	Various	-	-
High Temperature*	Various	°F [°C]	275 (145)
Low Temperature*	Various	°F [°C]	-65 (-54)
Fluid Resistance*	Various	-	-
RoHS	-	-	Pass

* Additional data available upon request
** Copies available at www.chomerics.com
*** All frequencies; 10 MHz to 18 GHz.

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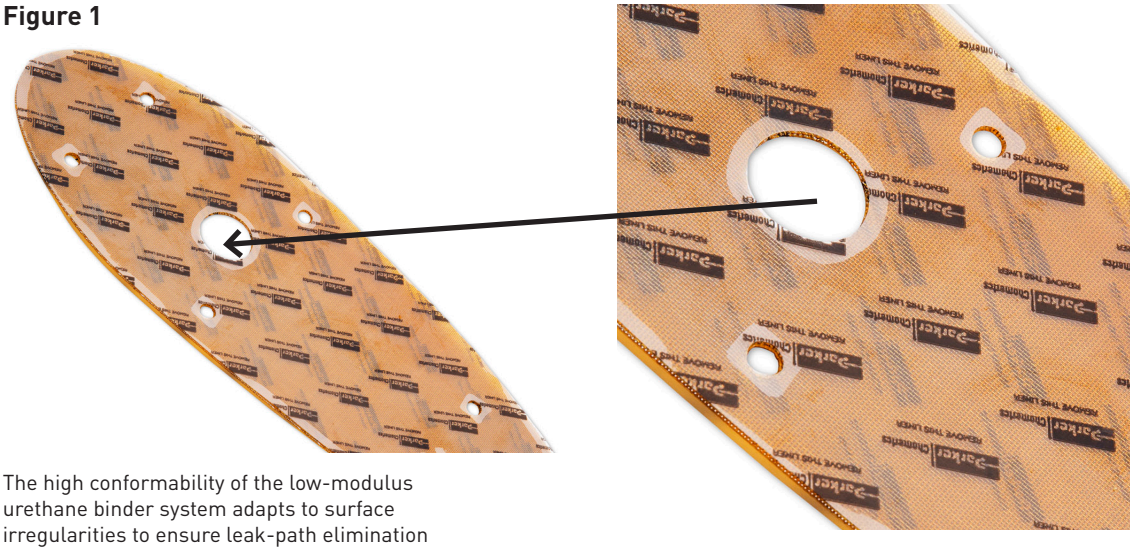
Sealing:

Performance associated with atmospheric pressure and fluid sealing were taken into consideration during material development. The high surface affinity and conformance associated with the urethane binder system utilized in this gasket formulation creates an extremely efficient sealing solution in highly variable applications such as those found between exterior mounted devices (i.e., antenna, lighting) and the aircraft fuselage. When subjected to specified torque values for these devices, pressure sealing of 20 PSI can be expected, while also effectively providing fluid sealing capabilities to common aviation fluids (reference DO-160, Environmental Conditions and Test Procedures for Airborne Equipment).

Figure 1

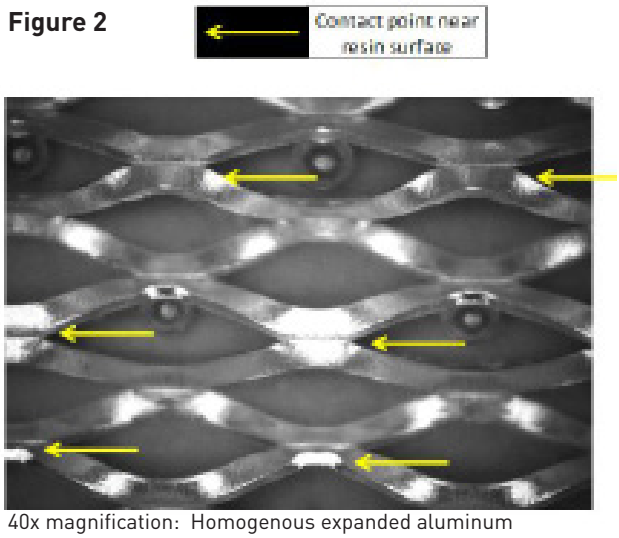


The high conformability of the low-modulus urethane binder system adapts to surface irregularities to ensure leak-path elimination and highly efficient sealing characteristics.

Electrical Conductivity:

Recognizing that lightning strike survivability and the avoidance of antenna signal interruption are paramount to gasket performance, Parker Chomerics focused on developing a high-efficiency material that optimizes electrical performance. Improving upon traditional gasketing alternatives, expanded aluminum was chosen as the conductive medium for this gasketing. Expanded aluminum improves upon electrical performance when compared to particle-filled or woven mesh alternatives by eliminating electrical contact resistance associated with point to point conductance requirements (e.g., particle to particle, wire to wire). The homogenous nature of expanded metal results in a supremely efficient electrical system which optimizes electrical ground performance, resulting in reduced safety liability associated with assembly failures caused by lightning strike or antenna signal detuning.

Figure 2



40x magnification: Homogenous expanded aluminum provides highly effective electrical performance.

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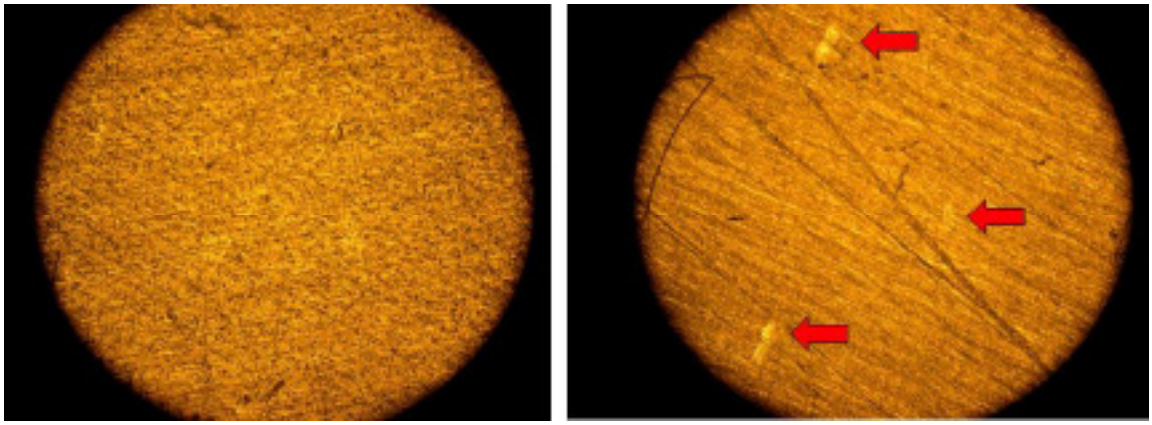
Airframe Pitting:

Understanding surface pitting of airframes and associated stress fatigue and cracking must be avoided, Parker Chomerics improved upon alternative conductive gasketing technologies. 3000 series aluminum was chosen as the conductive medium for this gasketing to ensure that when interfaced with harder aluminum components the gasketing would be the sacrificial entity of the assembly. Expanded aluminum also promotes an even distribution of interfacing surface load, resulting in the elimination of concentrated stress points which increase pitting occurrence.

As shown in Figure 3, microscopic inspection of substrates after gasket deflection shows no negative interaction with expanded metal-based gasketing. Alternatively, woven-wire based solutions have been found to create stress points at wire-overlap locations which can result in stress points that cause surface pitting.

Figure 3



40x magnification: Aluminum substrate surface after gasket interaction. Parker Chomerics expanded 3003 aluminum; left, Competitor A woven 5056 aluminum; right. Notice pristine surface finish after Parker Chomerics gasket installation versus localized surface pitting due to woven-wire induced stress points from Competitor A gasket installation (red arrows)

Corrosion:

Addressing customer concerns associated with aircraft total cost of ownership, Parker Chomerics developed a material that mitigates corrosion commonly associated with exterior mounted devices on aircraft. Optimization was addressed in two manners. Moisture ingress, and the resulting electrolytic environment, was minimized through increased sealing performance (see Sealing section of this note). Additionally, recognizing that aircraft and aircraft accessories commonly utilize aluminum as a base material for manufacturing, 3003 expanded aluminum was utilized as the conductive medium for this gasketing. By addressing material performance in these two ways, aircraft owners can expect significant reductions in rework and component replacement requirements commonly associated with corrosion.

Cold Flow:

Addressing customer feedback regarding multiple material trimming operations due to cold flow that is commonly associated with urethane antenna gasket technologies, Parker Chomerics can provide application specific analyses of gasket footprint size to limit material evacuation from the footprint of the installed device and the associated trimming steps. It is recommended to have compression stop integration done in parallel with this gasket size evaluation.

Silicone Contamination:

Recognizing that aircraft go through multiple painting operations throughout their lifespan and that silicone contamination is a major contributor to poor paint adhesion, Parker Chomerics developed a silicone-free gasketing solution. The urethane-based binder system facilitates easy removal without mechanical aid. Clean-up prior to painting can easily be done with common chemicals such as isopropyl alcohol.

Fastener Torque Retention:

Addressing voice of customer pain associated with loss of fastener torque retention commonly experienced with urethane antenna gasket technologies, Parker Chomerics provides optional compression stop integration into the mechanical design of specific gaskets to ensure urethane binder stress relaxation has no ill effects on fastener performance. This results in the elimination of multiple torque sequences during gasket installation.

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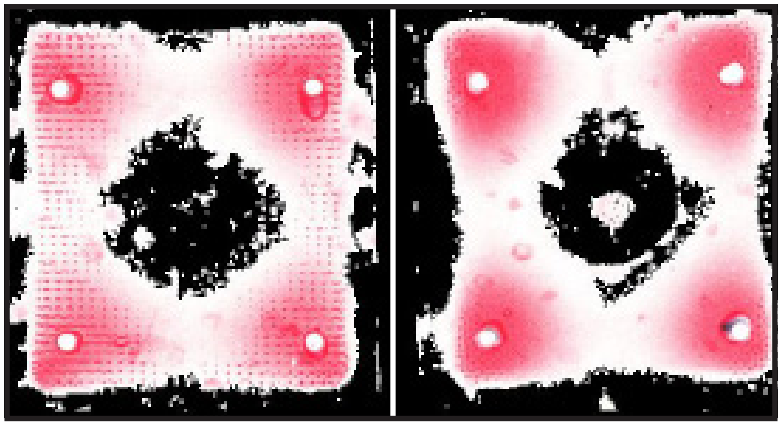
Assembly Integration:

Understanding that it is common for assembly designs to be predefined, Parker Chomerics developed a material that accommodates a wide-range of preexisting application parameters while maintaining a high level of electrical and sealing performance. Soft urethane is easily deflectable and can accommodate various mechanical designs (e.g., fastener spacing, fastener torque requirements, flange thickness). The patent pending expanded aluminum used in the gasketing ensures electrical conductivity at gasket deflection as low as 15%. Electrical conductivity at low deflection ranges guarantees a higher probability of surface to surface electrical contact between gasket and mating surfaces. More surface contact ensures higher electrical performance in highly variable or contoured assemblies.

Figure 4



Electrical contact surface plot for LRRA antenna. Black signifies no required contact area. Pink signifies adequate surface contact. White signifies inadequate surface contact. Parker Chomerics expanded aluminum gasket; left, Competitor A woven aluminum gasket; right. Note the improved electrical contact between the fasteners of the Parker Chomerics gasket versus the localized contact around the fasteners of the Competitor A gasket. Increased electrical surface contact improves overall system electrical performance.

Installation:

Focusing on material installation convenience, a symmetrical gasket cross section was designed. This symmetry allows for gasketing to be installed without z-axis orientation needing to be taken into consideration. This mistake-proof design ensures improved process yields when compared to alternative gasketing solutions that require material orientation to be considered.

Packaging

For added installation convenience, Parker Chomerics can design gasket-specific packaging that incorporates registering features that allow for gasket alignment. This alignment eliminates the potential need for gasket repositioning and the opportunity for associated gasket damage and yield loss.

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