Form-in-Place Conductive Gasket

Design Guidelines

Material Specifications

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PRESENTATION TOPICS

- Introduction to Cybershield
- Gasket Design Guidelines
- Shielding Effectiveness
- Form-in-Place Materials
- RoHS
- Summary
CYBERSHIELD OPERATION

- Based in Lufkin, TX
- Business Focus Since 1987
  - Metallization of Plastics
  - EMI Shielding Systems
  - Electroless & Electrolytic Plating and Conductive Paint
  - Form-in-Place Gasket
  - Mechanical Assembly
- Electronic Component & Equipment Manufacturers

Registered ISO 9001:2008
### SERVED MARKETS

<table>
<thead>
<tr>
<th>Category</th>
<th>Equipment</th>
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<tbody>
<tr>
<td>Connectors</td>
<td>Wireless Devices</td>
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<tr>
<td>Telecom Equipment</td>
<td>Networking Equipment</td>
</tr>
<tr>
<td>Servers/Routers</td>
<td>Storage Devices</td>
</tr>
<tr>
<td>Medical Electronics</td>
<td>Barcode/RFID Equipment</td>
</tr>
<tr>
<td>Military/Aerospace</td>
<td>Antenna</td>
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<tr>
<td>Industrial Equipment</td>
<td>ATM Equipment</td>
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<tr>
<td>Instrumentation</td>
<td>Test Equipment</td>
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<tr>
<td>Automotive Electronics</td>
<td>Mobile Handsets</td>
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<tr>
<td>Audio Electronics</td>
<td>GPS Systems</td>
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</table>
PLATING ON PLASTICS

All-Over Electroless
- Acid/Caustic Etch or Abrade
- Activate with Catalyst
- Plate 1-10 µm (40-400 µ") Copper, Nickel, Tin, Gold

Selective Plating Catalyst
- Mask Part
- Apply Auto-Catalytic Primer
- Plate 1-5 µm (40-200 µ") Copper, Nickel, Tin, Gold

Electrolytic Plating
- All-Over Electroless Plate
- Rack & Contact
- Plate 5-75 µm (200 µ”–.003") Copper, Nickel, Chrome
CONDUCTIVE PAINT

- Air Atomization of Metallic Paints
- Coatings
  - Graphite, Ni, Cu, Ag, Hybrid Cu-Ag
  - Thickness: 0.5-2.0 mils (0.0125-0.050 mm)
  - Electro-Form Mask for Selective Application
- Thickness Uniformity & Repeatability via Robotic Application
- Widest Resin Capability
- “Flexible” Conductive Paint for Application onto Paper or Fabric
FORM-IN-PLACE OVERVIEW

- Silicone with Silver Plated Nickel, Copper or Aluminum Filler
- Dispense onto Metal, Painted or Plated Plastic via PC Controlled Robot
- Shielding Effectiveness: 85-120 dB
- Compression Set: 10-20% @ 50% Deflection
- Shore A Hardness: 48-70
- Gasket Size Range
  - Height: 0.015”-0.090” (0.38-2.30 mm)
  - Width: 0.018”-0.125” (0.46 -3.20 mm)

Teamed with Laird Technologies to Dispense Form-in-Place Conductive Gaskets
FIP PLACEMENT

- Programmable 3-axis CNC Dispensing Robot
- Gasket on Multiple Levels & Slopes up to 70°
- Tolerances
  - Placement Tolerance ± 0.001”
  - Gasket Cross-Sectional Tolerances from ± 0.003”
### STANDARD GASKET DIMENSIONS

<table>
<thead>
<tr>
<th>Height (Inches (mm))</th>
<th>Width (Inches (mm))</th>
<th>Minimum Landing Area (Inches (mm))</th>
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<tbody>
<tr>
<td>0.015 ± 0.003 (0.4 ± 0.1)</td>
<td>0.020 ± 0.003 (0.5 ± 0.1)</td>
<td>0.025 (0.6)</td>
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<tr>
<td>0.020 ± 0.003 (0.5 ± 0.1)</td>
<td>0.024 ± 0.003 (0.6 ± 0.1)</td>
<td>0.029 (0.7)</td>
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<tr>
<td>0.027 ± 0.004 (0.7 ± 0.1)</td>
<td>0.030 ± 0.004 (0.8 ± 0.1)</td>
<td>0.036 (0.9)</td>
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<tr>
<td>0.030 ± 0.004 (0.8 ± 0.1)</td>
<td>0.034 ± 0.004 (0.9 ± 0.1)</td>
<td>0.040 (1.0)</td>
</tr>
<tr>
<td>0.040 ± 0.004 (1.0 ± 0.1)</td>
<td>0.048 ± 0.005 (1.2 ± 0.1)</td>
<td>0.055 (1.4)</td>
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<tr>
<td>0.045 ± 0.005 (1.1 ± 0.1)</td>
<td>0.059 ± 0.006 (1.5 ± 0.2)</td>
<td>0.067 (1.7)</td>
</tr>
<tr>
<td>0.055 ± 0.006 (1.4 ± 0.2)</td>
<td>0.075 ± 0.007 (1.9 ± 0.2)</td>
<td>0.084 (2.1)</td>
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</tbody>
</table>

- Gasket Dimensions Can Be Tailored to Requirements
- Gasket Height Nominally 80% of Width
- Double Dispensed Gaskets Possible to Meet Extraordinary Height to Width Specs
- Gasket Compression Range: 20-40%
- Comprehend Tolerance “Stack-up” and Impact on Gasket Compression
# Gasket Material Properties

<table>
<thead>
<tr>
<th>Properties</th>
<th>Test Method</th>
<th>Units</th>
<th>SNK55-RXP</th>
<th>SNN60-RXP</th>
<th>SNL60-RXP</th>
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</thead>
<tbody>
<tr>
<td>Conductive Particle Filler</td>
<td></td>
<td></td>
<td>Silver Plated Cu</td>
<td>Silver Plated Ni</td>
<td>Silver Plated Al</td>
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<tr>
<td>Volume Resistivity</td>
<td></td>
<td>Ohm-cm</td>
<td>0.002</td>
<td>0.005</td>
<td>0.003</td>
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<tr>
<td>Shielding Effectiveness</td>
<td>MIL-DTL-83528C</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>200 MHz to 10 GHz</td>
<td>Para. 4.5.12</td>
<td>dB</td>
<td>&gt;90</td>
<td>&gt;100</td>
<td>&gt;100</td>
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<tr>
<td>Hardness</td>
<td>ASTM D2240</td>
<td>Shore A</td>
<td>55</td>
<td>60</td>
<td>60</td>
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<tr>
<td>Tensile Strength</td>
<td>ASTM D412</td>
<td>kPa</td>
<td>1300</td>
<td>192</td>
<td>850</td>
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<tr>
<td>Tensile Elongation</td>
<td>ASTM D412</td>
<td>%</td>
<td>300</td>
<td>110</td>
<td>140</td>
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<tr>
<td>Density (cured)</td>
<td>ASTM D792</td>
<td>g/cm³</td>
<td>3.0</td>
<td>3.9</td>
<td>2.1</td>
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<tr>
<td>Density (uncured)</td>
<td>LT-FIP-CLE-09</td>
<td>g/cm³</td>
<td>2.3</td>
<td>3.1</td>
<td>1.8</td>
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<tr>
<td>Compression Set</td>
<td>ASTM D575</td>
<td>%</td>
<td>10</td>
<td>15</td>
<td>10</td>
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<tr>
<td>Adhesion Strength to Al</td>
<td>LT-FIP-CLE-03</td>
<td>N/cm²</td>
<td>200</td>
<td>180</td>
<td>140</td>
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<td>Compression Deflection</td>
<td>LT-FIP-CLE-07</td>
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<tr>
<td>at 20% compression</td>
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<td>lb/in</td>
<td>1.2</td>
<td>1.7</td>
<td>1.9</td>
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<tr>
<td>at 40% compression</td>
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<td>lb/in</td>
<td>5.2</td>
<td>6.4</td>
<td>8.3</td>
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<td>Temperature Range</td>
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<td>°C</td>
<td>-50 to 100</td>
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<td>-50 to 125</td>
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<td>UL Rating</td>
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<td>V0</td>
<td>V0</td>
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</table>
SHIELDING EFFECTIVENESS

SNL60-RXP
Shielding Effectiveness (dB)
Preliminary

Frequency (GHz)

dB Shielding

0
20
40
60
80
100
120
140
160

0.1
1
10
100
RoHS & REACH COMPLIANCE

- RoHS: EU Directive - Restriction of Hazardous Substances
  - Lead, Cadmium, Mercury, Hexavalent Chromium, Polybrominated Biphenyl (PBB), Polybrominated Diphenyl Ether (PBDE) Flame Retardants
  - All Laird FIP Gasket Materials RoHS Compliant

- European Chemical Association Identified Substances of Very High Concern (SVHC)
  - Toxic, Carcinogenic, Long Term Environmental and/or Health Issues
  - Laird FIP Gasket Materials Contain No SVHC
SUMMARY

- Demonstrated FIP Processes
  - Excellent EMI Shielding Effectiveness
  - Cost Effective
  - High Volume Production Capacity

- Design Flexibility
  - Gasket Dimensions
  - Gasket Pattern/Locations
  - Straightforward Design Modifications