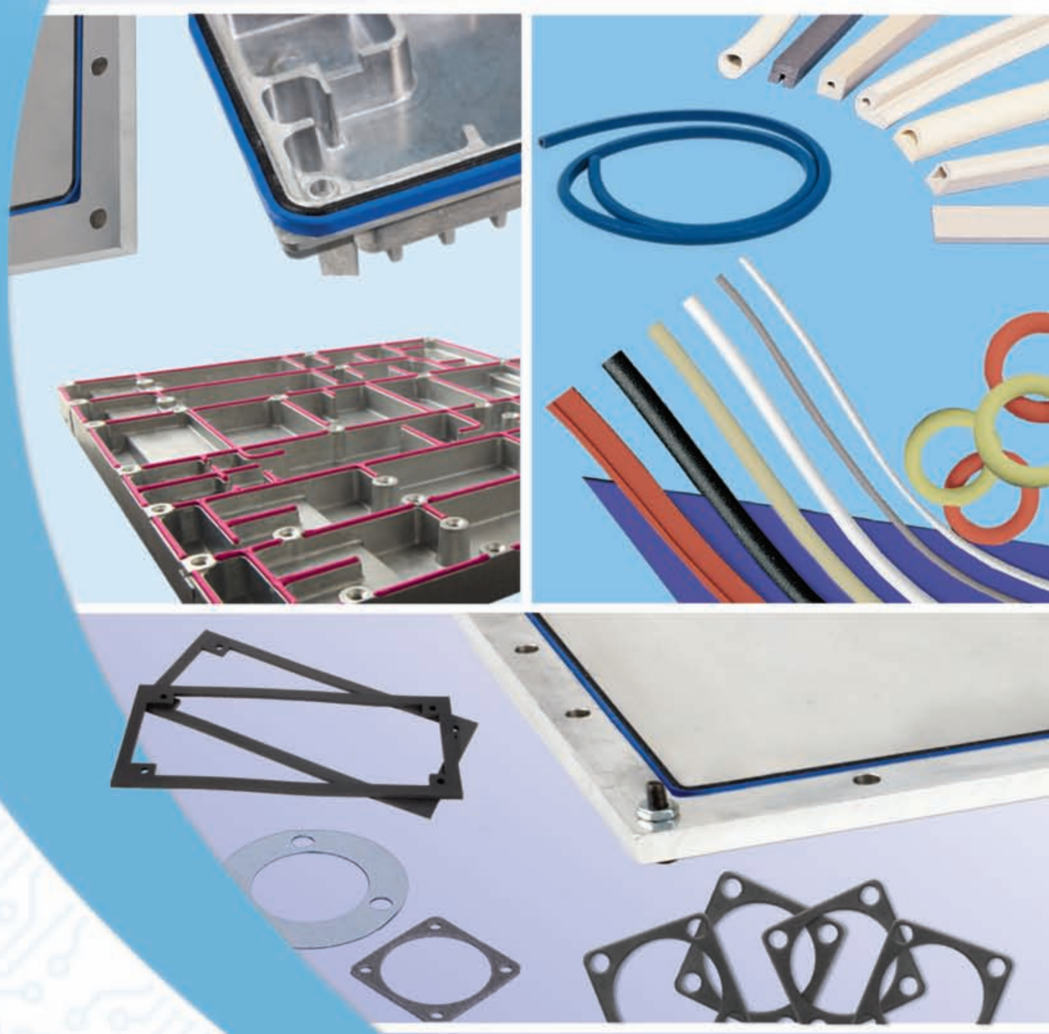
Elastomeric EMI Shielding

SOLUTIONS

www.lairdtech.com



Laird™

TABLE OF CONTENTS

All parts listed in this catalog are lead free and RoHS compliant.

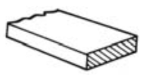
This catalog contains a limited selection of Laird Technologies products. Refer to www.lairdtech.com for other products not included in this catalog.

Notice:

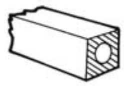
Information on the products described in this catalog is based on laboratory test data which Laird Technologies believes to be reliable. However, Laird Technologies has no control over the design of actual products which incorporate Laird Technologies' products or actual fabrication of devices using Laird Technologies' products. Accordingly, Laird Technologies cannot guarantee that the same test data as described herein will be obtained. Thus, it is recommended that each user make their own tests to confirm laboratory test data and determine suitability of Laird Technologies' products for their particular application.

VISUAL PART REFERENCE GUIDE

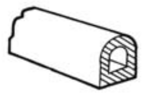
ELECTROSEAL CONDUCTIVE ELASTOMERS



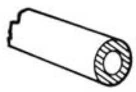
Rectangular Strips
Page 15



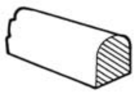
Hollow Rectangular Strips
Page 15



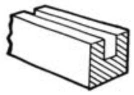
Hollow D-Strips
Page 16



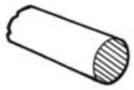
O-StripTubing
Page 17



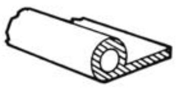
D-Strips
Page 18



Channel Strips
Page 18

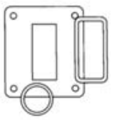


O-Strips
Page 19



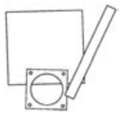
P-Strip Tubing
Page 20

ELECTROSEAL CONDUCTIVE ELASTOMER FABRICATED COMPONENTS



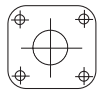
Page 23

METAL IMPREGNATED MATERIALS



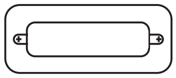
Page 30

MIL CONNECTOR GASKETS



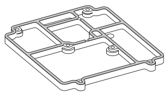
Page 34

"D" SUBMINIATURE CONNECTOR SHIELDS



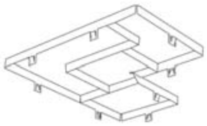
Page 36

FORM-IN-PLACE EMI DISPENSED GASKETS



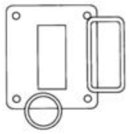
Page 38

MOLD-IN-PLACE PRINTED CIRCUIT BOARD SHIELDING



Page 40

ELECTROCOAT



Page 41

BOARD TO CHASSIS CONDUCTIVE STAND-OFF

Page 42

INTRODUCTION TO ELECTRICALLY CONDUCTIVE ELASTOMERS

OVERVIEW

The electrically conductive elastomers are based on dispersed particles in elastomers, oriented wire in solid or sponge elastomers, impregnated wire mesh screens or expanded metals. They provide highly conductive, yet resilient gasketing materials for EMI sealing as well as pressure and environmental sealing.

Conductive elastomers are used for shielding electronic enclosures against electromagnetic interference (EMI). Usually, the shielding system consists of a conductive gasket sandwiched between a metal housing and lid. The primary function of these gaskets is to provide sufficient electrical conductivity across the enclosure/gasket/lid junction to meet grounding and EMI shielding requirements, as well as prevent intrusion of the fluids into the electrical components.

Laird Technologies offers conductive elastomers in the following forms:

1. ElectroSeal dispersed filler particles in elastomers
2. ElectroMet oriented wire in solid and sponge elastomers, and impregnated wire mesh and expanded metals

ELECTROSEAL™ GASKET INTRODUCTION

Conductive elastomer gaskets are EMI shielding and sealing devices made from highly conductive, mechanically resilient and conformable vulcanized elastomers. They are available in the following types:

1. Flat gaskets or die-cuts
2. Molded shapes such as O-rings or intricate parts
3. Extruded profiles or strips
4. Vulcanized-to-metal covers or flanges
5. Co-molded or reinforced seals
6. Form-in-place gaskets

When any two flat, but rigid surfaces are brought together, slight surface irregularities on each surface prevent them from meeting completely at all points. These irregularities may be extremely minute, yet may provide a leakage path for gas or liquid under pressure, and for high frequency electromagnetic energy. This problem remains in flange sealing even when very high closure force is applied.

However, when a gasket fabricated of resilient material is installed between the mating surfaces, and even minimal closure pressure is applied, the resilient gasket conforms to the irregularities in both mating surfaces. As a result, all surface imperfections and potential leak paths across the joint area are sealed completely against pneumatic and fluid pressure or penetration by environmental gases. If the gasket is conductive as well as resilient, with conductive matrix distributed throughout its total volume in mesh or particle form, the joint can be additionally sealed against penetration by, or exit of, electromagnetic energy.

DESIGN CONSIDERATIONS

The design requirements of the installation will usually narrow the choice considerably, particularly if the basic geometry of the enclosure is already established, or if military EMI shielding specifications are involved. In addition to choices of size and shape dictated by the enclosing structure and the joint geometry itself, the following four factors greatly influence the suitability of EMI gasket materials: shielding effectiveness, closure force, percent gland fill and compression/deflection.

INTRODUCTION TO ELECTRICALLY CONDUCTIVE ELASTOMERS

SERVICE LIFE

Three fundamental factors are involved when considering the service life of an EMI gasket:

1. The presence of detrimental chemicals and fluids, ozone aging and temperature extremes.
2. The number of times the joint will be opened and closed during the projected operating life of the equipment.
3. Potential exposure to inadvertent damage during initial installation and future maintenance.

ENVIRONMENTAL CONSIDERATIONS

Proper material selection for effective EMI shielding depends on the total environmental envelope within which the seal/shield will be expected to function. The material selection process should begin with a careful analysis of the following major environmental conditions:

- Temperature
- Aging/Shelf Life
- Pressure/Vacuum
- Fluid Compatibility
- Galvanic Compatibility

TEMPERATURE

Temperature, though seemingly elementary, is often the most misunderstood and exaggerated of all sealing environment parameters; hence, it is all too often over-specified.

Low Temperature

Low temperature induced changes in the elastomer properties are generally physical in nature. As the temperature decreases below allowable limits, the elastomeric properties are lost and the material becomes very hard and brittle. Duration of the effects of low temperature exposure is not significant and the original properties are regained upon resumption of moderate temperatures.

High Temperature

High temperatures also affect the properties of elastomers in the same way as the low temperatures. As the temperature begins to rise, the elastomer will soften, lowering its extrusion resistance. Tensile strength and modulus also decrease under high temperatures, and elongation is increased. But these initial changes reverse if exposure to high temperatures is brief. Changes due to prolonged high temperature exposure are chemical in nature rather than physical, and are not reversible.

The temperature capabilities of various ElectroSeal elastomers are shown in Table 2.

**TABLE 2.
TEMPERATURE CAPABILITIES OF
PRINCIPAL ELECTROSEAL ELASTOMERS**

ELASTOMER TYPE	LOW TEMPERATURE	UPPER TEMPERATURE
EPDM	-58°F (-50°C)	257°F (125°C)
Silicone	-49°F (-45°C)	392°F (200°C)
Fluorosilicone	-67°F (-55°C)	347°F (175°C)

AGING/SHELF LIFE

Another major factor in the selection of any elastomer destined for sealing/shielding service is time, or more properly, seal life. The expected life of a seal may involve only a few seconds in the case of some highly specialized seals used in solid propellant rocket casings, to as much as 10 to 20 years and beyond in the case of seals used in deep-space vehicles.

Deterioration with time or aging relates to the type of polymer and storage conditions. Exposure may cause deterioration of elastomers whether installed or in storage. Resistance to deterioration in storage varies greatly between the elastomers. Military Handbook 695 (MIL-HDBK-695) divides synthetic elastomers in the following groups according to age resistance as shown in Table 3.

**TABLE 3.
AGE RESISTANCE OF PRINCIPAL ELECTROSEAL ELASTOMERS**

BASE POLYMER	ASTM DESIGNATION	SHELF LIFE (YEARS)
Ethylene Propylene Diene Monomer	EPDM	5 to 10 Years
Silicone MQ, VMQ,	PVMQ	Up to 20 Years
Fluorosilicone	FVMQ	Up to 20 Years

PRESSURE VACUUM

Conductive elastomer seals are rarely used for high-pressure systems, with the exception of waveguide seals. Pressure has a bearing on the choice of material and hardness. Low durometer materials are used for low pressure applications, whereas high pressure may require a combination of material hardness and design.

Outgassing and/or sublimation in a high vacuum system can cause seal shrinkage (loss of volume), resulting in a possible loss of sealing ability. When properly designed and confined, an O-ring, molded shape, or a molded-to-the-cover plate seal can provide adequate environmental sealing as well as EMI shielding for vacuum (to 1 x 10-6 Torr) applications.

INTRODUCTION TO ELECTRICALLY CONDUCTIVE ELASTOMERS

MATERIAL SELECTION GUIDE

Laird Technologies offers a series of products to meet a wide range of customer requirements for military and commercial applications. The classifications of the most common materials are based on cost and specific applications and are outlined in Table 5.

TABLE 5

PARAMETER	TEST METHOD								
Filler		Ni/graphite	silver/copper	silver/Al	silver	silver	silver/nickel	silver/glass	carbon
Elastomer		silicone	silicone	silicone	silicone	silicone	silicone	silicone	silicone
EcE Name		EcE72	EcE80	EcE81	EcE82	EcE83	EcE84	EcE85	EcE87
Electrical Properties									
Volume Resistivity, Ω cm, max	MIL-DTL-83528C para 4.5.10	0.100	0.004	0.008	0.002	0.010	0.005	0.006	5.0
Shielding Eff, 10 GHz, dB, min	MIL-DTL-83528C para 4.5.12	100	120	100	120	80	100	100	30
Physical Properties									
Density, g/cm^3 (±0.25)	ASTM D792	2.30	3.40	2.00	3.50	1.80	4.00	1.90	1.30
Hardness, Shore A (±7)	ASTM D2240	75	65	65	65	45	75	65	75
Tensile Strength, psi, min	ASTM D412	280	200	200	300	150	200	200	700
Elongation	ASTM D412	150%	100-300%	100-300%	100-300%	50-250%	100-300%	100-300%	100-300%
Tear Strength, ppi, min	ASTM D624, die C	55	25	30	50	20	30	30	50
Compression Set, max	ASTM D395	30%	32%	32%	45%	35%	32%	30%	45%
Max Oper. Temp., °C	MIL-DTL-83528C para 4.5.15	160	125	160	160	160	125	160	160
Min. Oper. Temp., °C	ASTM D1329	-55	-55	-55	-55	-55	-55	-55	-55
Flame Retardance	UL 94	V-0 Pending		UL 94 HB (File No. E203 070					
Electrical Stability									
After Heat Aging, Ω cm, max	MIL-DTL-83528C para 4.5.15	-	0.010	0.010	0.010	0.015	0.010	0.015	7.0
After Break, Ω cm, max	MIL-DTL-83528C para 4.5.9	-	0.008	0.015	0.010	0.020	0.010	0.009	7.0
During Vibration, Ω cm, max	MIL-DTL-83528C para 4.5.13	-	0.006	0.012	0.010	0.015	0.010	0.009	N/A
After Exposure to EMP, Ω cm, max	MIL-DTL-83528C para 4.5.16	-	0.010	0.010	0.010	0.015	0.010	0.015	N/A
Compression / Deflection, %, min	ASTM D575	8	3.5	3.5	2.5	8.0	3.5	3.5	3.5
Fluid Immersion[1]	MIL-DTL-83528C para 4.5.17	-	NS	NS	NS	NS	NS	NS	NS
Manufacturing Processes									
molded sheet / diecut parts		X	X	X	X	X	X	X	X
molded shapes / O-rings		X	X	X	X	X	X	X	X
extruded profiles		X	X	X	X	X	X	X	
Color		gray	tan	tan	beige	beige	tan	tan	black
Mil-DTL-83528 Type		–	A	B	E	J	L	M	–

1 SUR indicates meets the immersion test requirements for 10 specified military/aerospace fluids
2 UL94 V-1
3 used only for low density low hardness
4 UL94 HB
5 corrosion resistant silver/Al filler

INTRODUCTION TO ELECTRICALLY CONDUCTIVE ELASTOMERS

EMI GASKET MOUNTING TECHNIQUES

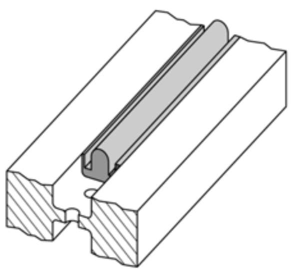
Common EMI gasket mounting techniques are:

POSITIONING IN A GROOVE

This is a highly recommended method if a suitable groove can be provided at a relatively low cost. Placing the EMI gasket in such a groove provides several advantages:

a. metal-to-metal contact of mating flange surfaces provides a compression stop and prevents overcompression of the gasket material;
b. is cost-effective by reducing assembly time;
c. best overall seal for EMI, EMP, salt fog, NBC, and fluids by providing metal-to-metal flange contact and reducing exposure of the seal element to attack by outside elements.

FIGURE 2



INTERFERENCE FIT APPLICATIONS

Allow 0.005 in. (0,1 mm) to 0.100 in. (2,5 mm) interference for part to hold and eliminate the need for adhesive. Groove depth should be set to ensure that the channel is not over-filled.

WATER TIGHT APPLICATIONS

Fill channel with as much material as possible, taking tolerances into account. Use caution to avoid overfill conditions.

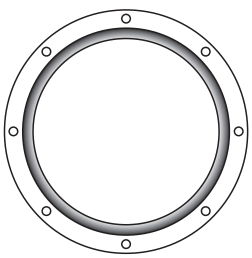
BONDING WITH ADHESIVES

The EMI gasket may be attached to one of the mating flanges by the application of pressure sensitive or permanent adhesives. A suitable conductive adhesive is always preferable over a nonconductive adhesive for mounting EMI gaskets as they can provide adequate electrical contact between the EMI gasket and the mounting surface.

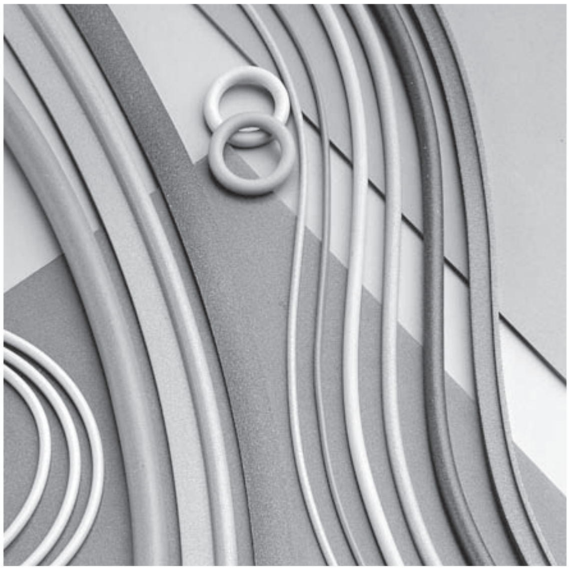
BOLT-THROUGH HOLES

This is a common and inexpensive way to hold an EMI gasket in position. Locator bolt holes can be accommodated in the tab or in rectangular flat gaskets as shown in Figure 3.

FIGURE 3



ELECTROSEAL CONDUCTIVE ELASTOMER MATERIAL



ELECTROSEAL™ CONDUCTIVE ELASTOMER EMI SHIELDING

Laird Technologies electrically conductive elastomer products are ideal for both military and commercial applications requiring both environmental sealing and EMI shielding. Compounds can be supplied in molded or extruded shapes, sheet stock, custom extruded, or die-cut shapes to meet a wide variety of applications.

Our conductive extrusions offer a wide choice of profiles to fit a large range of applications. The cross-sections shown on the following pages are offered as standard. Custom dies can be built to accommodate your specific design.

- Available in a wide variety of conductive filler materials
- Shielding effectiveness up to 120 dB at 10 GHz

SHEET MATERIAL

Table 1 lists thicknesses and sizes for our molded sheet material, while Table 2, pages 10-11, shows the compounds available for all of our conductive silicone elastomers.

HOW TO SPECIFY ECE

Decide on molded sheet stock or extruded shapes. Select the desired configuration and dimensions from Table 1 (for sheet stock) or Figures 1–8 (for extruded shapes). Select the desired material from Table 2. Insert material number from Table 2, |pages 14–17, in place of the letters XX in the Laird Technologies part number.

Example

1. From Figure 1, on page 18, for a rectangular strip measuring 0.500 in. (12,7 mm) x 0.075 in. (1,9 mm), part number is 8861-0130-XX.

2. From Table 2, on page 16, for silver-nickel filler, material number is 84.

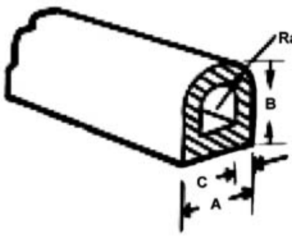
3. Ordering part number is 8861-0130-84.*

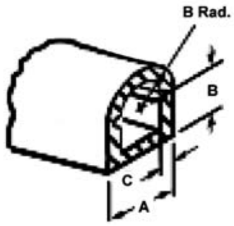
Note: Rectangular and D-shaped extrusions can be supplied with pressure sensitive adhesive tape.

*If pressure sensitive adhesive is required, replace the fifth digit with a 9 (i.e. 8861-9130-84).

THICKNESS/TOLERANCE	10 X 10 SHEET	10 X 15 SHEET	15 X 20 SHEET	18 X 18 SHEET
0.020 ± 0.004 (0,5 ± 0,1)	8860-0020-100-XX	8860-0020-150-XX	8860-0020-300-XX	N/A
0.032 ± 0.005 (0,8 ± 0,1)	8860-0032-100-XX	8860-0032-150-XX	8860-0032-300-XX	8860-0032-324-XX
0.045 ± 0.005 (1,1 ± 0,1)	8860-0045-100-XX	8860-0045-150-XX	8860-0045-300-XX	8860-0045-324-XX
0.062 ± 0.007 (1,5 ± 0,2)	8860-0062-100-XX	8860-0062-150-XX	8860-0062-300-XX	8860-0062-324-XX
0.093 ± 0.010 (2,3 ± 0,3)	8860-0093-100-XX	8860-0093-150-XX	8860-0093-300-XX	8860-0093-324-XX
0.100 ± 0.010 (2,5 ± 0,3)	8860-0100-100-XX	8860-0100-150-XX	8860-0100-300-XX	8860-0100-324-XX
0.125 ± 0.010 (3,2 ± 0,3)	8860-0125-100-XX	8860-0125-150-XX	8860-0125-300-XX	8860-0125-324-XX

Hollow D-Strips





TOLERANCES ALL PROFILES

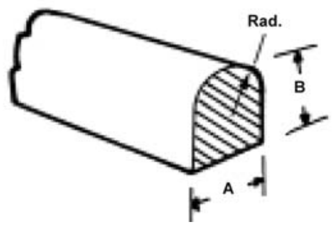
DIMENSIONS	TOLERANCE
Under 0.101 (2,6)	± 0.005 (0,15)
0.101 to 0.200 (2,6 to 5,1)	± 0.008 (0,2)
0.201 to 0.300 (5,1 to 7,6)	± 0.010 (0,3)
0.301 to 0.500 (7,6 to 12,7)	± 0.015 (0,4)
Over 0.500 (12,7)	± 0.020 (0,5)

MIL-DTL-83528 PART NUMBER	PART NUMBER	DIMENSIONS				
		A	B	RAD	C	VIEW
	8866-0135	0.093 (2,4)	0.093 (2,4)	0.046 (1,2)	0.027 (0,7)	A
	8866-0160	0.098 (2,5)	0.098 (2,5)	0.049 (1,2)	0.020 (0,5)	A
	8866-0130	0.100 (2,5)	0.094 (2,4)	0.050 (1,3)	0.025 (0,6)	A
	8866-0162	0.109 (2,8)	0.125 (3,2)	0.054 (1,4)	0.024 (0,6)	A
M83528/007X001	8866-0100	0.156 (4,0)	0.156 (4,0)	0.078 (2,0)	0.045 (1,1)	A
	8866-0111	0.156 (4,0)	0.156 (4,0)	0.078 (2,0)	0.027 (0,7)	A
	8866-0103	0.158 (4,0)	0.240 (6,1)	0.079 (2,0)	0.040 (1,0)	A
	8866-0136	0.160 (4,1)	0.120 (3,0)	0.080 (2,0)	0.025 (0,6)	A
M83528/007X002	8866-0105	0.187 (4,8)	0.187 (4,8)	0.093 (2,4)	0.050 (1,3)	A
	8866-0131	0.250 (6,4)	0.145 (3,7)	0.125 (3,2)	0.030 (0,8)	A
	8866-0050	0.250 (6,4)	0.250 (6,4)	0.125 (3,2)	0.050 (1,3)	B
M83528/007X007	8866-0110	0.250 (6,4)	0.250 (6,4)	0.125 (3,2)	0.065 (1,7)	A
M83528/007X005	8866-0120	0.312 (7,9)	0.312 (7,9)	0.112 (2,8)	0.062 (1,6)	A
M83528/007X004	8866-0116	0.312 (7,9)	0.312 (7,9)	0.156 (4,0)	0.062 (1,6)	B
	8866-0127	0.325 (8,3)	0.575 (14,6)	0.287 (7,3)	0.080 (2,0)	A
	8866-0168	0.358 (9,1)	0.374 (9,5)	0.179 (4,5)	0.039 (1,0)	A
	8866-0166	0.374 (9,5)	0.252 (6,4)	0.187 (4,8)	0.039 (1,0)	A
	8866-0134	0.375 (9,5)	0.250 (6,4)	0.090 (2,3)	0.050 (1,3)	B
	8866-0137	0.375 (9,5)	0.250 (6,4)	0.187 (4,8)	0.032 (0,8)	A
	8866-0169	0.421 (10,7)	0.427 (10,8)	0.210 (5,3)	0.039 (1,0)	A
	8866-0126	0.480 (12,2)	0.335 (8,5)	0.240 (6,1)	0.035 (0,9)	A
M83528/007X006	8866-0125	0.487 (12,4)	0.324 (8,2)	0.244 (6,2)	0.062 (1,6)	A
	8866-0148	0.488 (12,4)	0.312 (7,9)	0.244 (6,2)	0.055 (1,4)	A
	8866-0139	0.488 (12,4)	0.324 (8,2)	0.244 (6,2)	0.063 (1,6)	A
	8866-0129	0.500 (12,7)	0.312 (7,9)	0.250 (6,4)	0.050 (1,3)	A
	8866-0155	0.625 (15,9)	0.400 (10,2)	0.312 (7,9)	0.057 (1,4)	A

All dimensions shown are in inches (millimeters) unless otherwise specified.

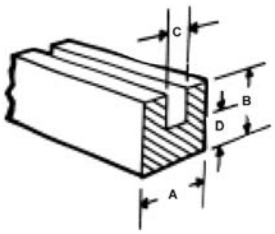
EXTRUSIONS GUIDE

D-Strips



MIL-DTL-83528 PART NUMBER	PART NUMBER	DIMENSIONS			RECOMMENDED GROOVE DIMENSIONS (±0.002)	
		A	B	RAD	WIDTH	DEPTH
	8865-0100	0.055 (1,4)	0.064 (1,6)	0.031 (0,8)	0.067 (1,7)	0.053 (1,3)
MB83528/003X001	8865-0105	0.062 (1,6)	0.068 (1,7)	0.031 (0,8)	0.074 (1,9)	0.057 (1,4)
MB83528/003X005	8865-0120	0.062 (1,6)	0.100 (2,5)	0.031 (0,8)	0.076 (1,9)	0.084 (2,1)
MB83528/003X010	8865-0140	0.075 (1,9)	0.178 (4,5)	0.089 (2,3)	0.093 (2,4)	0.150 (3,8)
MB83528/003X004	8865-0116	0.093 (2,4)	0.093 (2,4)	0.047 (1,2)	0.109 (2,8)	0.077 (2,0)
MB83528/003X002	8865-0110	0.094 (2,4)	0.078 (2,0)	0.047 (1,2)	0.109 (2,8)	0.065 (1,7)
MB83528/003X008	8865-0135	0.118 (3,0)	0.156 (4,0)	0.059 (1,5)	0.140 (3,6)	0.131 (3,3)
MB83528/003X007	8865-0130	0.122 (3,1)	0.135 (3,4)	0.061 (1,5)	0.141 (3,6)	0.113 (2,9)
MB83528/003X006	8865-0125	0.150 (3,8)	0.110 (2,8)	0.075 (1,9)	0.165 (4,2)	0.092 (2,3)
MB83528/003X003	8865-0115	0.178 (4,5)	0.089 (2,3)	0.039 (1,0)	0.182 (4,3)	0.074 (1,9)
MB83528/003X011	8865-0144	0.188 (4,8)	0.188 (4,8)	0.094 (2,4)	0.220 (5,6)	0.160 (4,1)
MB83528/003X012	8865-0145	0.250 (6,4)	0.250 (6,4)	0.125 (3,2)	0.286 (7,3)	0.212 (5,4)

Channel Strips



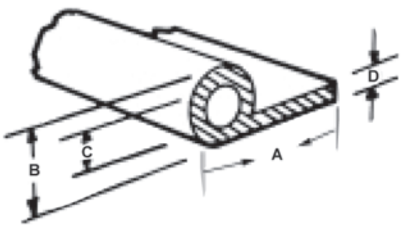
TOLERANCES ALL PROFILES

DIMENSIONS	TOLERANCE
Under 0.101 (2,6)	± 0.005 (0,15)
0.101 to 0.200 (2,6 to 5,1)	± 0.008 (0,2)
0.201 to 0.300 (5,1 to 7,6)	± 0.010 (0,3)
0.301 to 0.500 (7,6 to 12,7)	± 0.015 (0,4)
Over 0.500 (12,7)	± 0.020 (0,5)

MIL-DTL-83528 PART NUMBER	PART NUMBER	DIMENSIONS			
		A	B	C	D
M83528/010X001	8868-0100	0.100 (2,5)	0.100 (2,5)	0.034 (0,9)	0.033 (0,8)
	8868-0055	0.114 (2,9)	0.082 (2,1)	0.030 (0,8)	0.026 (0,7)
M83528/010X002	8868-0105	0.126 (3,2)	0.110 (2,8)	0.025 (0,6)	0.050 (1,3)
M83528/010X003	8868-0056	0.156 (4,0)	0.114 (2,9)	0.030 (0,8)	0.062 (1,6)
M83528/010X004	8868-0115	0.156 (4,0)	0.156 (4,0)	0.062 (1,6)	0.047 (1,2)
	8868-0067	0.175 (4,4)	0.500 (12,7)	0.047 (1,2)	0.075 (1,9)
M83528/010X005	8868-0120	0.175 (4,4)	0.156 (4,0)	0.047 (1,2)	0.075 (1,9)
	8868-0081	0.189 (4,8)	0.189 (4,8)	0.063 (1,6)	0.063 (1,6)
	8868-0084	0.250 (6,4)	0.250 (6,4)	0.062 (1,6)	0.062 (1,6)
	8868-0085	0.252 (6,4)	0.252 (6,4)	0.126 (3,2)	0.063 (1,6)
M83528/010X006	8868-0125	0.327 (8,3)	0.235 (6,0)	0.062 (1,6)	0.115 (2,9)
	8868-0070	0.395 (1,0)	0.120 (3,0)	0.275 (7,0)	0.060 (1,5)
	8868-0075	0.530 (13,5)	0.130 (3,3)	0.390 (9,9)	0.060 (1,5)

All dimensions shown are in inches (millimeters) unless otherwise specified.

P-Strips



TOLERANCES ALL PROFILES

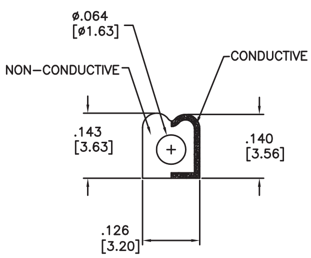
DIMENSIONS	TOLERANCE
Under 0.101 (2,6)	± 0.005 (0,15)
0.101 to 0.200 (2,6 to 5,1)	± 0.008 (0,2)
0.201 to 0.300 (5,1 to 7,6)	± 0.010 (0,3)
0.301 to 0.500 (7,6 to 12,7)	± 0.015 (0,4)
Over 0.500 (12,7)	± 0.020 (0,5)

MIL-DTL-83528 PART NUMBER	PART NUMBER	DIMENSIONS			
		A	B	C	D
	8867-0136	0.275 (7,0)	0.140 (3,6)	0.085 (2,2)	0.030 (0,8)
	8867-0147	0.290 (7,4)	0.095 (2,4)	0.062 (1,6)	0.025 (0,6)
	8867-0144	0.390 (9,9)	0.200 (5,1)	0.103 (2,6)	0.062 (1,6)
	8867-0128	0.415 (10,5)	0.200 (5,1)	0.060 (1,5)	0.062 (1,6)
	8867-0141	0.425 (10,8)	0.250 (6,4)	0.151 (3,8)	0.050 (1,3)
M83528/008X007	8867-0101	0.475 (12,1)	0.200 (5,1)	0.080 (2,0)	0.062 (1,6)
	8867-0127	0.500 (12,7)	0.200 (5,1)	0.076 (1,9)	0.062 (1,6)
M83528/008X002	8867-0105	0.500 (12,7)	0.250 (6,4)	0.125 (3,2)	0.062 (1,6)
	8867-0126	0.600 (15,2)	0.250 (6,4)	0.125 (3,2)	0.062 (1,6)
M83528/008X004	8867-0102	0.640 (16,3)	0.208 (5,3)	0.080 (2,0)	0.072 (1,8)
	8867-0158	0.752 (19,1)	0.252 (6,4)	0.189 (4,8)	0.063 (1,6)
	8867-0165	0.752 (19,1)	0.437 (11,1)	0.347 (8,8)	0.060 (1,5)
M83528/008X006	8867-0130	0.780 (19,8)	0.360 (9,1)	0.255 (6,5)	0.070 (1,8)
M83528/008X001	8867-0100	0.850 (21,6)	0.200 (5,1)	0.080 (2,0)	0.062 (1,6)
	8867-0166	0.874 (22,2)	0.500 (12,7)	0.400 (10,2)	0.065 (1,7)
M83528/008X005	8867-0125	0.875 (22,2)	0.312 (7,9)	0.187 (4,8)	0.062 (1,6)

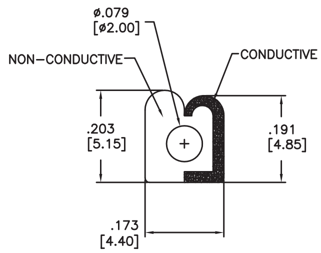
All dimensions shown are in inches (millimeters) unless otherwise specified.

GEMINI COEXTRUSIONS

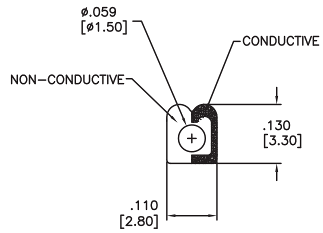
M



8890-MGS103072-93

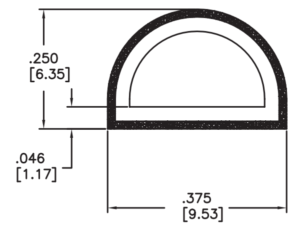


8890 0001 XX A



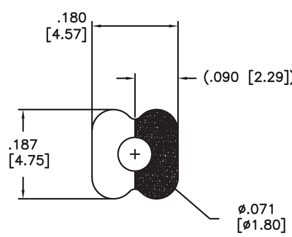
8890 0002 XX A

D

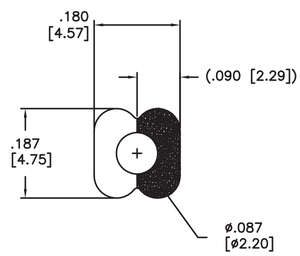


8894 0001 XX A

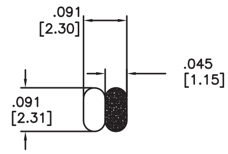
DD



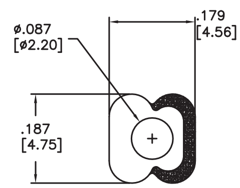
8898 0001 XX A



8898 0002 XX A



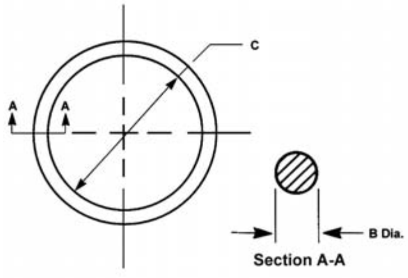
8899 0001 XX A



8898 0003 XX A

All dimensions shown are in inches (millimeters) unless otherwise specified.

Molded EMI O-Rings



TOLERANCES: TABLE 1 AND TABLE 2

INNER DIMENSIONS : C	TOLERANCES
0.100 to 1.500 (3 to 38)	± 0.010 (0,3)
1.501 to 2.500 (38 to 64)	± 0.015 (0,4)
2.501 to 4.500 (64 to 114)	± 0.020 (0,5)
4.501 to 7.000 (114 to 178)	± 0.025 (0,6)
over 7.000 (178)	± 0.35% nom. dim.

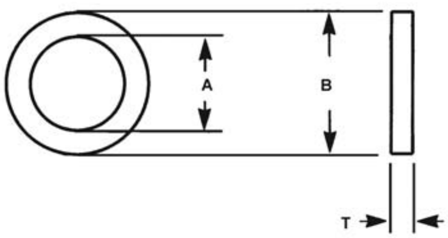
CROSS SECTION DIMENSIONS : B	TOLERANCES
0.000 to 0.070 (0,0 to 1,8)	± 0.003 (0,1)
0.071 to 0.200 (1,8 to 5,1)	± 0.005 (0.1)
0.201 to 0.400 (5,1 to 10,2)	± 0.006 (0,2)

TABLE 1. MIL-DTL-83528 SERIES

MIL-DTL-83528 PART NO.	LAIRD TECHNOLOGIES PART NO	DIMENSIONS	
		C	B
	8563-0322-XX	0.050 (1,3)	0.063 (1,6)
M83528/002X007	8563-0068-XX	0.145 (3,7)	0.070 (1,8)
	8563-0143-XX	0.150 (3,8)	0.062 (1,6)
	8563-0334-XX	0.176 (4,5)	0.070 (1,8)
	8563-0326-XX	0.260 (6,6)	0.030 (0,8)
	8563-0343-XX	0.270 (6,9)	0.070 (1,8)
M83528/005X006	8563-0106-XX	0.295 (7,5)	0.048 (1,2)
M83528/002X011	8563-0069-XX	0.301 (7,6)	0.070 (1,8)
M83528/002X012	8563-0070-XX	0.364 (9,2)	0.070 (1,8)
	8563-0243-XX	0.415 (10,5)	0.057 (1,4)
M83528/002X013	8563-0071-XX	0.426 (10,8)	0.070 (1,8)
M83528/005X008	8563-0108-XX	0.446 (11,3)	0.051 (1,3)
M83528/002X014	8563-0072-XX	0.489 (12,4)	0.070 (1,8)
	8563-0196-XX	0.492 (12,5)	0.070 (1,8)
	8563-0327-XX	0.500 (12,7)	0.100 (2,5)
M83528/002X015	8563-0073-XX	0.551 (14,0)	0.070 (1,8)
M83528/005X016	8563-0116-XX	0.610 (15,5)	0.070 (1,8)
M83528/002X114	8563-0091-XX	0.612 (15,5)	0.103 (2,6)
	8563-0285-XX	0.632 (16,1)	0.062 (1,6)
M83528/002X017	8563-0074-XX	0.676 (17,2)	0.070 (1,8)
	8563-0211-XX	0.676 (17,2)	0.070 (1,8)
M83528/002X018	8563-0075-XX	0.739 (18,8)	0.070 (1,8)
	8563-0218-XX	0.755 (19,2)	0.097 (2,5)
M83528/002X019	8563-0076-XX	0.801 (20,3)	0.070 (1,8)
M83528/002X020	8563-0077-XX	0.864 (21,9)	0.070 (1,8)
	8563-0344-XX	0.921 (23,4)	0.139 (3,5)
M83528/002X021	8563-0078-XX	0.926 (23,5)	0.070 (1,8)
M83528/002X022	8563-0079-XX	0.989 (25,1)	0.070 (1,8)
	8563-0213-XX	0.989 (25,1)	0.070 (1,8)
	8563-0279-XX	1.000 (25,4)	0.250 (6,4)
	8563-0062-XX	1.100 (27,9)	0.070 (1,8)
M83528/002X024	8563-0080-XX	1.114 (28,3)	0.070 (1,8)
M83528/005X013	8563-0113-XX	1.182 (30,0)	0.068 (1,7)
M83528/002X026	8563-0089-XX	1.239 (31,5)	0.070 (1,8)
	8563-0161-XX	1.239 (31,5)	0.070 (1,8)
M83528/002X126	8563-0094-XX	1.362 (34,6)	0.103 (2,6)
M83528/002X028	8563-0090-XX	1.364 (34,6)	0.070 (1,8)
	8563-0165-XX	1.366 (34,7)	0.070 (1,8)
	8563-0324-XX	1.463 (37,2)	0.080 (2,0)
M83528/002X128	8563-0095-XX	1.487 (37,8)	0.103 (2,6)
	8563-0164-XX	1.487 (37,8)	0.103 (2,6)
	8563-0166-XX	1.489 (37,8)	0.070 (1,8)
M83528/005X022	8563-0122-XX	1.612 (40,9)	0.103 (2,6)
M83528/002X132	8563-0096-XX	1.737 (44,1)	0.103 (2,6)

All dimensions shown are in inches (millimeters) unless otherwise specified.

Flat Washer Gaskets



TOLERANCES (ALL DIMENSIONS)

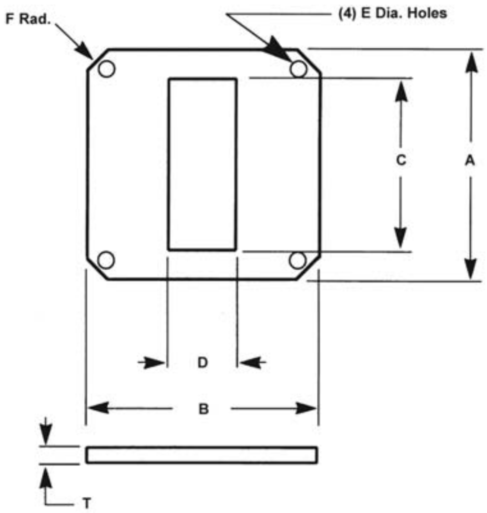
DIMENSIONS	TOLERANCE
Under 0.101 (0,0 to 2,6)	± 0.005 (0,1)
0.101 to 0.200 (2,6 to 5,1)	± 0.010 (0,3)
0.201 to 0.500 (5,1 to 12,7)	± 0.015 (0,4)
Over 0.500 (12,7)	± 0.020 (0,5)

TABLE 3. MIL-DTL-83528 SERIES

MIL-DTL-83528 PART NO.	LAIRD TECHNOLOGIES PART NO.	DIMENSIONS		
		A	B	T
	8560-0231-XX	0.120 (3,0)	0.260 (6,6)	0.030 (0,8)
	8560-0234-XX	0.171 (4,3)	0.390 (9,9)	0.060 (1,5)
	8560-0233-XX	0.218 (5,5)	0.468 (11,9)	0.030 (0,8)
M83528/012X001	8560-0097-XX	0.250 (6,4)	0.625 (15,9)	0.032 (0,8)
M83528/012X002	8560-0158-XX	0.250 (6,4)	0.562 (14,3)	0.060 (1,5)
	8560-0435-XX	0.250 (6,4)	0.750 (19,1)	0.032 (0,8)
	8560-0299-XX	0.319 (8,1)	0.422 (10,7)	0.075 (1,9)
M83528/012X004	8560-0143-XX	0.375 (9,5)	0.750 (19,1)	0.062 (1,6)
M83528/012X003	8560-0098-XX	0.375 (9,5)	0.750 (19,1)	0.031 (0,8)
	8560-0331-XX	0.375 (9,5)	0.750 (19,1)	0.032 (0,8)
	8560-0444-XX	0.380 (9,7)	0.960 (24,4)	0.065 (1,7)
	8560-0200-XX	0.433 (11,0)	0.508 (12,9)	0.045 (1,1)
M83528/012X005	8560-0099-XX	0.500 (12,7)	0.656 (16,7)	0.031 (0,8)
M83528/012X007	8560-0100-XX	0.500 (12,7)	0.875 (22,2)	0.031 (0,8)
M83528/012X006	8560-0144-XX	0.500 (12,7)	0.656 (16,7)	0.062 (1,6)
M83528/012X008	8560-0145-XX	0.500 (12,7)	0.875 (22,2)	s0.062 (1,6)
	8560-0330-XX	0.500 (12,7)	0.656 (16,7)	0.032 (0,8)
	8560-0311-XX	0.641 (16,3)	0.703 (17,9)	0.032 (0,8)
	8560-0505-XX	0.800 (20,3)	1.000 (25,4)	0.156 (4,0)
	8560-0453-XX	0.890 (22,6)	1.250 (31,8)	0.062 (1,6)

All dimensions shown are in inches (millimeters) unless otherwise specified.

Rectangular Waveguide Gaskets



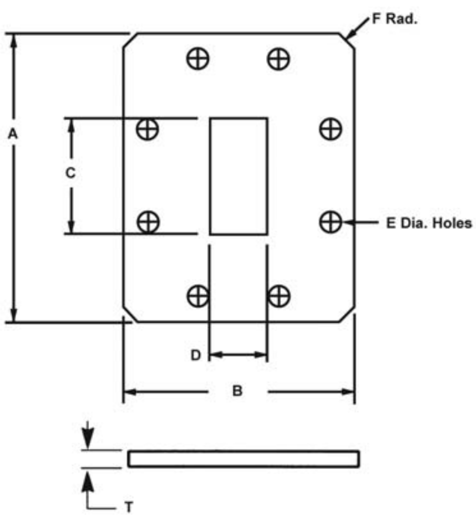


TABLE 7.

MIL-DTL-83528 PART NO.	LAIRD TECHNOLOGIES PART NO.	DIMENSIONS						
		A	B	C	D	E	T	F RADIUS
M83528/013X001	8560-0104-XX Fig. 1	± 0.750 (19,1)	± 0.750 (19,1)	± 0.145 (3,7)	± 0.285 (7,2)	± 0.116 (2,9)	± 0.027 (0,7)	± 0.469 (11,9)
M83528/013X003	8560-0105-XX Fig. 1	0.875 (22,2)	0.875 (22,2)	0.175 (4,4)	0.425 (10,8)	0.116 (2,9)	0.027 (0,7)	0.563 (14,3)
M83528/013X005	8560-0106-XX Fig. 1	1.313 (33,4)	1.313 (33,4)	0.630 (16,0)	0.320 (8,1)	0.140 (3,6)	0.027 (0,7)	0.875 (22,2)
M83528/013X007	8560-0103-XX Fig. 1	1.496 (38,0)	1.496 (38,0)	0.760 (19,3)	0.385 (9,8)	0.155 (3,9)	0.027 (0,7)	0.450 (11,4)
M83528/013X009	8560-0107-XX Fig. 1	1.625 (41,3)	1.625 (41,3)	0.905 (23,0)	0.405 (10,3)	0.169 (4,3)	0.027 (0,7)	0.469 (11,9)
M83528/013X015	8560-0108-XX Fig. 1	1.875 (47,6)	1.875 (47,6)	1.130 (28,7)	0.505 (12,8)	0.180 (4,6)	0.027 (0,7)	1.150 (29,2)
M83528/013X016	8560-0113-XX Fig. 2	1.750 (44,5)	2.500 (63,5)	0.505 (12,8)	1.130 (28,7)	0.171 (4,3)	0.027 (0,7)	0.250 (6,4)
M83528/013X020	8560-0114-XX Fig. 2	1.937 (49,2)	2.687 (68,3)	0.633 (16,1)	1.380 (35,1)	0.206 (5,2)	0.027 (0,7)	0.250 (6,4)
M83528/013X027	8560-0116-XX Fig. 2	3.500 (88,9)	2.500 (63,5)	1.880 (47,8)	0.880 (22,4)	0.226 (5,7)	0.027 (0,7)	0.313 (8,0)
M83528/013X028	Fig. 2	1.764 (44,8)	2.781 (70,6)	0.882 (22,4)	1.882 (47,8)	0.156 (4,0) 0.141	0.027 (0,7)	0.125 (3,2)
M83528/013X031	Fig. 2	2.750 (69,9)	3.875 (98,4)	1.155 (29,3)	2.300 (58,4)	0.270 (6,9)	0.027 (0,7)	0.312 (7,9)
M83528/013X040	8560-0110-XX Fig. 2	4.188 (106,4)	6.344 (161,1)	2.160 (54,9)	4.310 (109,5)	0.266 (6,8) 0.281 (7,1)	0.027 (0,7)	0.250 (6,4)

Note: Compound 98 is silicone material filled with Ag/Cu and expanded metal. See Material Compounds chart on

All dimensions shown are in inches (millimeters) unless otherwise specified.

METAL IMPREGNATED MATERIALS

ELECTROMET™ ORIENTED WIRE

ElectroMet oriented wire gaskets are EMI shielding and sealing composites. Monel® or aluminum wires embedded in the elastomer and oriented perpendicular to the mating surfaces provide the EMI sealing. Solid or sponge silicone provides the weather sealing; however, solid silicone weather seals are recommended for high-pressure applications.

Silicone based oriented wire composites are capable of withstanding temperature ranges from –70°F to 500°F (–56°C to 260°C). Oriented wire materials are available in sheet or strip form with a minimum thickness of 0.032 in. (0,8 mm). Material specifications and information for standard sheets and strips are provided in Tables 1 through 3.

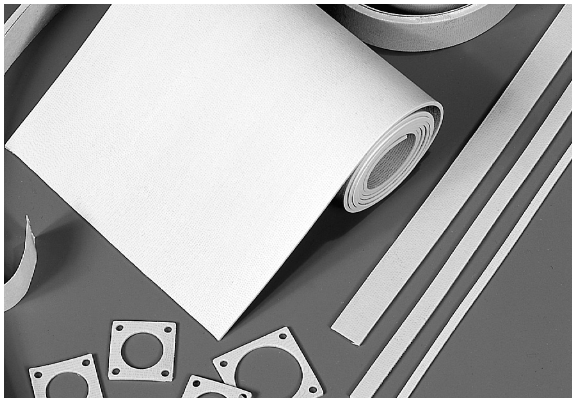
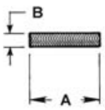


TABLE 1.

MATERIAL CODE	ELASTOMER	WIRE SPECIFICATION
55	Silicone Sponge Per AMS 3195	Monel: Alloy Per QQ N281 Dia. 0.0045 (0,114)
56	Silicone Solid Per ZZR765 Class 2b Grade 40	Monel: Alloy Per QQ N281 Dia. 0.0045 (0,114)
58	Silicone Sponge Per AMS 3195	Aluminum: Alloy 5056 Per AMS 4182 Dia. 0.005 (0,127)
59	Silicone Solid Per ZZR765 Class 2b Grade 40	Aluminum: Alloy 5056 Per AMS 4182 Dia. 0.005 (0,127)

Note: Wire density per sq. in.: 700–900; per sq. cm 108–139
55 not available in thickness below .062"

TABLE 2. ELECTROMET SHEET MATERIALS

END VIEW	PART NO.	DIMENSIONS	
		A. WIDTH	B. THICKNESS
	8408-0200-XX	3.000 (76,2)	0.032 (0,8)
	8408-0203-XX	3.000 (76,2)	0.045 (1,1)
	8408-0206-XX	3.000 (76,2)	0.062 (1,6)
	8408-0209-XX	3.000 (76,2)	0.093 (2,4)
	8408-0212-XX	3.000 (76,2)	0.125 (3,2)
	8408-0213-XX	3.000 (76,2)	0.187 (4,8)
	8408-0215-XX	4.500 (114,3)	0.032 (0,8)
	8408-0218-XX	4.500 (114,3)	0.045 (1,1)
	8408-0221-XX	4.500 (114,3)	0.062 (1,6)
	8408-0227-XX	4.500 (114,3)	0.125 (3,2)
	8408-0230-XX	6.000 (152,4)	0.032 (0,8)
	8408-0242-XX	6.000 (152,4)	0.125 (3,2)
	8408-0245-XX	9.000 (228,6)	0.032 (0,8)
	8408-0248-XX	9.000 (228,6)	0.045 (1,1)
	8408-0251-XX	9.000 (228,6)	0.062 (1,6)
	8408-0254-XX	9.000 (228,6)	0.093 (2,4)
	8408-0257-XX	9.000 (228,6)	0.125 (3,2)

HOW TO SPECIFY

1. For PSA, change the fifth digit to 9 for items with tape.
   Example: 8408-0200-59 becomes 8408-9200-59.

2. Replace XX with material code from Table 1.
   Example: To request a 3.0 in. (76,2 mm) wide x 0.032 in. (0,8 mm) thick strip with aluminum wire in solid silicone sponge, use 8408-0200-59.

For further information or for product samples, please contact Laird Technologies sales department.

All dimensions shown are in inches (millimeters) unless otherwise specified.

METAL IMPREGNATED MATERIALS

DIE-CUT GASKET

Oriented wire can be supplied as a die-cut gasket in various configurations. Gasket sizes are available up to 9 in. (228,6 mm) X 36 in. (914,4 mm). Several of the most common die-cut gaskets are for cable connectors and Sub-D connectors shown in Figures 2a and 2b.

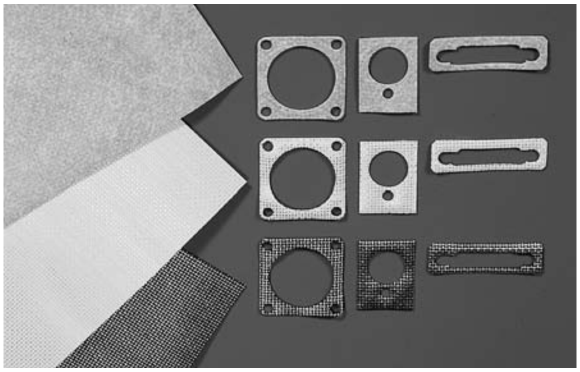
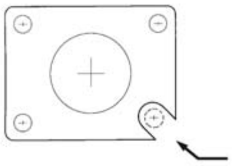
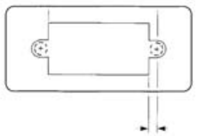


FIGURE 2A. CABLE CONNECTOR



Corner holes may be slotted at Laird Technologies option

FIGURE 2B. SUB-D CONNECTOR



Holes closer to edges than 2x material thickness will be made as "u" slots at Laird Technologies option

ELECTROMET IMPREGNATED WOVEN WIRE AND EXPANDED METAL

ElectroMet impregnated wire mesh and expanded metal gaskets are available in thin sheet form. EMI shielding is provided by woven aluminum mesh or expanded metals. Pressure sealing is provided by neoprene or silicone elastomer impregnated in the mesh. Fluorosilicone is also available for specific applications that require resistance to oils, hydraulic fluids and hydrocarbon fuels.

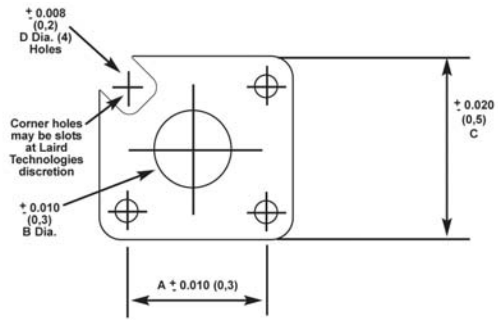
TABLE 1. MATERIAL SELECTION

PART NO.	THICKNESS FILLER	WIDTH	MATERIAL DESCRIPTION	MATERIAL SPECIFICATIONS		
				METAL FILLER	ELASTOMER FILLER	COLOR
8416-0120-57	0.020 ± 0.004 (0,5 ± 0,1)	8.0 (203,2)	Woven Wire Neoprene Impregnated	Aluminum 5056 Alloy Per AMS 3222	Neoprene Per AMS 4182	Black
8416-0120-23	0.020 ± 0.004 (0,5 ± 0,1)	8.0 (203,2)	Woven Wire Silicone Impregnated	Aluminum 5056 Alloy Per AMS 4182	Silicone Per ZZR 765, Class 2B, Grade 50	Gray
8416-0320-21	0.020 ± 0.004 (0,5 ± 0,1)	8.0 (203,2)	Expanded Metal with Elastomer	Aluminum 5056 Alloy Per AMS 4182	Silicone Per ZZR 765, Class 2B, Grade 50	Gray
8416-0330-21	0.030 ± 0.004 (0,8 ± 0,1)					
8416-0320-22	0.020 ± 0.004 (0,5 ± 0,1)	8.0 (203,2)	Expanded Metal with Elastomer	Monel® per QQ-N-281B	Silicone Per ZZR 765, Class 2B, Grade 50	Gray
8416-0330-22	0.030 ± 0.004 (0,8 ± 0,1)					

All dimensions shown are in inches (millimeters) unless otherwise specified.

METAL IMPREGNATED MATERIALS

MIL Connector Gaskets



Note: Holes closer to edges than 2x material thickness will be made as "u" slots at Laird Technologies option

TABLE 2A. AN CONNECTOR GASKET PER MIL-C-5015 MS3102

SHELL SIZE	DIMENSIONS (SEE FIGURE 1)				
	A	B	C	D	BASE PART NO.
8	0.594 (15,1)	0.500 (12,7)	0.875 (22,2)	0.172 (4,4)	8516-0101-XX
10	0.719 (18,3)	0.625 (15,9)	1.000 (25,4)	0.172 (4,4)	8516-0102-XX
12	0.813 (20,7)	0.750 (19,5)	1.094 (27,8)	0.172 (4,4)	8516-0103-XX
14	0.906 (23,0)	0.875 (22,2)	1.188 (30,2)	0.172 (4,4)	8516-0104-XX
16	0.969 (24,6)	1.000 (25,4)	1.281 (32,5)	0.172 (4,4)	8516-0105-XX
18	1.063 (27,0)	1.125 (28,6)	1.375 (34,9)	0.203 (5,2)	8516-0106-XX
20	1.156 (29,4)	1.250 (31,8)	1.500 (38,1)	0 .203 (5,2)	8516-0107-XX
22	1.250 (31,8)	1.375 (34,9)	1.625 (41,3)	0.203 (5,2)	8516-0108-XX
24	1.375 (34,9)	1.500 (38,1)	1.750 (44,5)	0.203 (5,2)	8516-0109-XX
28	1.563 (39,7)	1.750 (44,5)	2.000 (50,8)	0.203 (5,2)	8516-0110-XX
32	1.750 (44,5)	2.000 (50,8)	2.250 (57,2)	0 .219 (5,6)	8516-0111-XX
40	2.188 (55,6)	2.438 (61,9)	2.750 (69,9)	0.219 (5,6)	8516-0114-XX

TABLE 2B. PT, PC, AND JT CONNECTOR GASKET PER MIL-C-26482 MS3110, 3112, 2119, 3120

SHELL SIZE	DIMENSIONS (SEE FIGURE 1)				
	A	B	C	D	BASE PART NO.
8	0.594 (15,1)	0.500 (12,7)	0.812 (20,6)	0.130 (3,3)	8516-0118-XX
10	0.719 (18,3)	0.625 (15,9)	0.938 (23,8)	0.130 (3,3)	8516-0119-XX
12	0.813 (20,7)	0.750 (19,1)	1.031 (26,2)	0.130 (3,3)	8516-0120-XX
14	0.906 (23,0)	0.875 (22,2)	1.125 (28,6)	0.130 (3,3)	8516-0121-XX
16	0.969 (24,6)	1.000 (25,4)	1.219 (31,0)	0.130 (3,3)	8516-0122-XX
18	1.063 (27,0)	1.125 (28,6)	1.312 (33,3)	0.130 (3,3)	8516-0123-XX
20	1.156 (29,4)	1.250 (31,8)	1.438 (36,5)	0.130 (3,3)	8516-0124-XX
22	1.250 (31,8)	1.375 (34,9)	1.563 (39,7)	0.130 (3,3)	8516-0125-XX
24	1.375 (34,9)	1.500 (38,1)	1.688 (42,9)	0.130 (3,3)	8516-0126-XX

TABLE 2C. GASKETS FOR BENDIX SP CONNECTORS

SHELL SIZE	DIMENSIONS (SEE FIGURE 1)				
	A	B	C	D	BASE PART NO.
12	0.938 (23,8)	0.750 (19,1)	1.250 (31,8)	0.160 (4,1)	8516-0130-XX
14	1.031 (26,2)	0.875 (22,2)	1.344 (34,1)	0.160 (4,1)	8516-0131-XX
16	1.125 (28,6)	1.000 (25,4)	1.437 (36,5)	0.160 (4,1)	8516-0132-XX
20	1.297 (32,9)	1.250 (31,8)	1.672 (42,5)	0.160 (4,1)	8516-0134-XX
22	1.375 (34,9)	1.375 (34,9)	1.750 (44,5)	0.160 (4,1)	8516-0135-XX

TABLE 2D. RF CONNECTORS

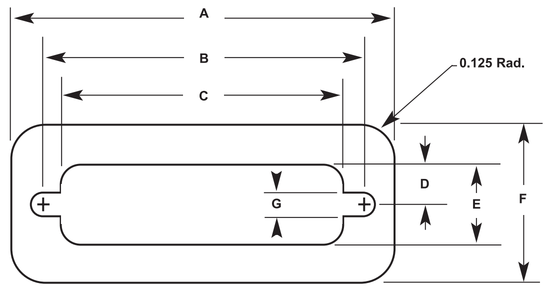
SHELL SIZE	DIMENSIONS (SEE FIGURE 1)				
	A	B	C	D	BASE PART NO.
BN	0.500 (12,7)	0.437 (11,1)	0.687 (17,5)	0.109 (2,8)	8516-0136-XX
BNC	0.500 (12,7)	0.437 (11,1)	0.687 (17,5)	0.109 (2,8)	8516-0137-XX
C	0.719 (18,3)	0.625 (15,9)	1.000 (25,4)	0.172 (4,4)	8516-0138-XX
N	0.719 (18,3)	0.625 (15,9)	1.000 (25,4)	0.172 (4,4)	8516-0141-XX

All dimensions shown are in inches (millimeters) unless otherwise specified.

METAL IMPREGNATED MATERIALS

"D" Subminiature Connector Shields

- Available in 9 pin to 50 pin "D" Connector styles
- Versatile front or rear mounting
- Custom shapes and designs available



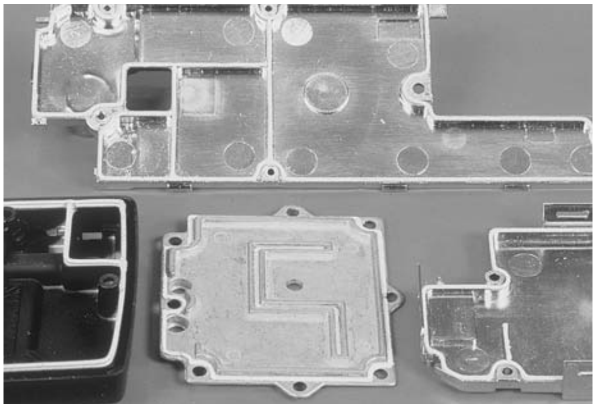
"D" CONNECTOR SERIES DIMENSIONS FOR ELASTOMERS

PART NO.	THICKNESS	# PINS	A	B	C	D	E	F	G
TOLERANCE:			± 0.015 (0,4)	± 0.010 (0,2)	± 0.015 (0,4)	REF	± 0.010 (0,3)	± 0.015 (0,4)	± 0.010 (0,3)
8516-0208-XX 8516-0201-XX	0.030 (0,8) 0.060 (1,5)	9	1.410 (35,8)	0.980 (24,9)	0.780 (19,8)	0.220 (5,6)	0.440 (11,2)	0.690 (17,5)	0.130 (3,3)
8516-0209-XX 8516-0203-XX	0.030 (0,8) 0.060 (1,5)	15	1.740 (44,2)	1.310 (33,3)	1.110 (28,2)	0.220 (5,6)	0.440 (11,2)	0.690 (17,5)	0.130 (3,3)
8516-0210-XX	0.030 (0,8)	25	2.280	1.850	1.650	0.220	0.440	0.690	0.130
8516-0211-XX 8516-0204-XX	0.030 (0,8) 0.060 (1,5)	37	2,930 (74,4)	2.500 (63,5)	2.290 (58,2)	0.220 (5,6)	0.440 (11,2)	0.690 (17,5)	0.130 (3,3)
8516-0212-XX 8516-0205-XX	0.030 (0,8) 0.060 (1,5)	50	2.840 (72,1)	2.410 (61,2)	2.110 (53,6)	0.280 (7,1)	0.550 (14,0)	0.800 (20,3)	0.240 (6,1)

To order replace XX with material code from the Material Compounds chart on pages 10-11.

All dimensions shown are in inches (millimeters) unless otherwise specified.

AUTOMATED FORM-IN-PLACE EMI GASKET TECHNOLOGIES



Laird Technologies form-in-place gasketing is ideal for hand held electronics applications.

PROGRAMMING SOFTWARE

Programming of the dispensing equipment can be facilitated utilizing part samples or part drawings. We also support the following CAD formats: AutoCAD®, DXF®, IGES®, Pro/ENGINEER®.

The software is user-friendly and includes several useful tools to simplify the path programming. These include scaling, symmetries, rotation, segment ends definition, and robotic dispensing instructions.

All production parameters are controlled by the software to include dispensing speed, start point, number of parts on the pallet, time needed to process one part, and automatic shut-down for cartridge reloading.

EXCEPTIONAL QUALITY

All material undergoes batch testing before application to guarantee superior mechanical and electrical properties. All dispensed products are manufactured to the exacting requirements of our ISO 9001 certified facility.

PACKAGING

To prevent damage to the substrate and gasket, and to facilitate handling, parts should be shipped in trays. Parts should be held securely to the tray to prevent movement during shipping, and packaged to avoid contact with each other. If required, Laird Technologies can design special packaging and trays to suit your specific part requirements. Store in the freezer prior to use.

MOLD-IN-PLACE PRINTED CIRCUIT BOARD SHIELDING

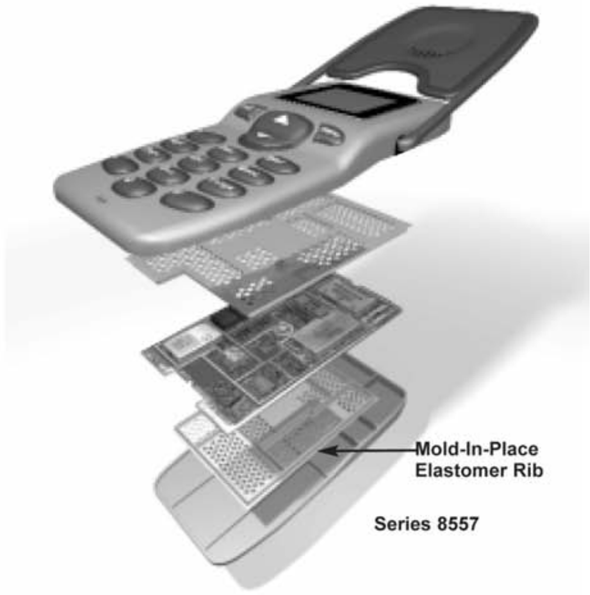
Laird Technologies introduces its Series #8557 mold-in-place capabilities for printed circuit board shielding applications. Based upon each specific design application, a molded-in-place rib pattern, made of silver or silver coated particles in a silicone base, can be applied to any metal substrate creating a multi-compartment, shielded enclosure. During installation, the shield is sandwiched between one side of the printed circuit board and the housing. As the housing is assembled, the mold-in-place ribs are compressed, providing the shield. Access to the components is accomplished by simple disassembly of the housing.

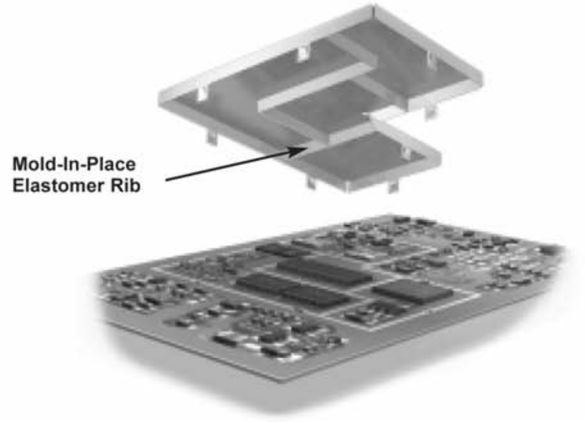
The mold-in-place rib enclosure design is ideally suited for portable devices, hand held computers, and wireless communications devices.

- Replaces multiple soldered printed circuit board shield cans with a single piece approach
- Ideal for hand held devices where space is at a premium
- The metal substrate acts as a shielded enclosure allowing the use of a non-conductive housing Metal component can be custom designed in various shapes, mounting tabs, and heights
- Elastomer mold-in-place ribs can be provided with a tapered design to lower compression force
- Available in other material compounds, consult sales

Laird Technologies can custom mold-in-place on your provided substrates, or you can utilize our vast metal stamping technology and have us manufacture the substrate.

To order, please specify desired rib pattern and provide a layout of the designed matching ground traces on the printed circuit board.





All dimensions shown are in inches (millimeters) unless otherwise specified.

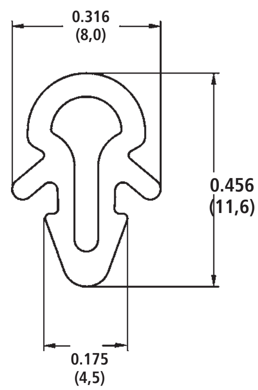
SPECIALTY PRODUCTS

BOARD TO CHASSIS CONDUCTIVE STAND-OFF

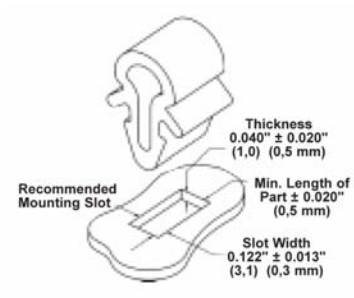
Laird Technologies offers a multi-functional grounding device that provides electrical contact between the bottom of printed circuit boards and enclosure housings. The snap in feature allows for easy assembly and secure retention. Once inserted, the part makes contact with the base of the printed circuit board on a grounding pad or trace, assuring superior grounding.

- Solves EMI and/or ESD problems via superior grounding (maximum 0.8 Ohm DC resistance)
- Provides damping of vibration and spacing between grounded surfaces
- Available in two standard lengths (custom lengths also available)
- Design of part facilitates simple robotic automation
- Minimum compression force required within operating range (see chart below)

PROFILE DIMENSION



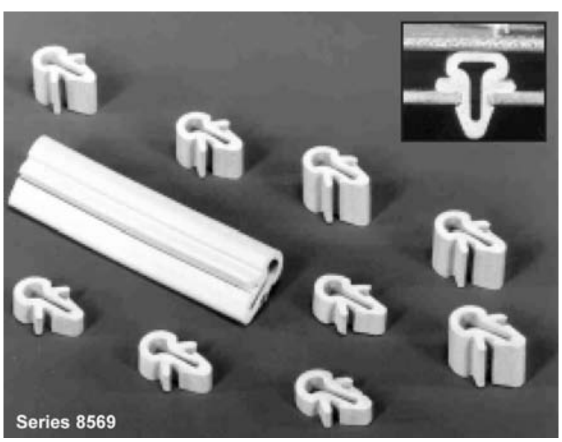
MOUNTING INFORMATION

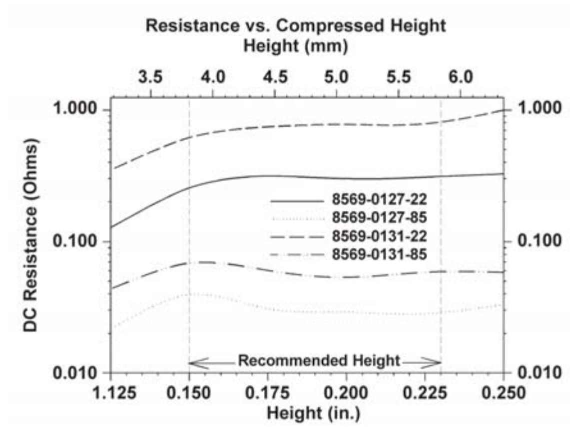


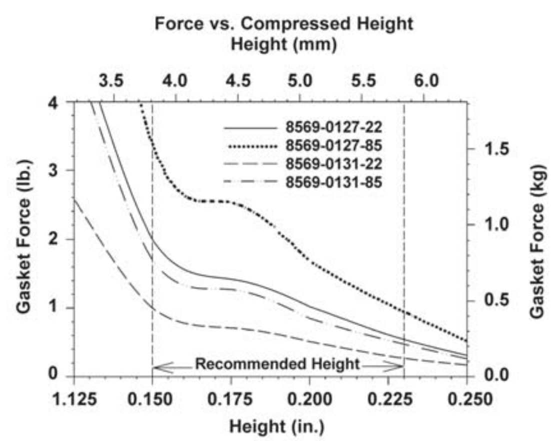
ORDERING INFORMATION

Select part from table below. Insert desired compound number in place of XX. Custom lengths are also available.

PART NO.	LENGTH
8569-0127-XX	0.250 (6,4)
8569-0131-XX	0.125 (3,2)
ECE COMPOUND 85	ECE COMPOUND 22
Silver/Glass	Nickel/Graphite







CORROSION OF EMI GASKETS

GALVANIC CORROSION OF ELECTRICALLY CONDUCTIVE ELASTOMERS

The galvanic series provides a relative ranking for selecting compatible metallic couples. However, electrically conductive elastomers are a composite material that behaves differently from metals due to diffusion rates and elastomeric nature of the gaskets. In addition, the presence of corrosion inhibitors which continuously coat the exposed flanges also affects the corrosion rate. Therefore, the direct application of the metallic-based galvanic series to the conductive elastomers could be misleading. The corrosion behavior of the conductive elastomers is affected by the nature of the filler particles, the permeability of the elastomer matrix, and the presence of corrosion inhibitors.

Electrically conductive elastomers are effective shielding materials because they provide good attenuation to electromagnetic radiation, while at the same time providing an environmental seal. When conductive elastomers are assembled in an enclosure, they are in intimate contact with some type of metal flange and readily conduct current. These two conditions, intimate contact with a metallic substrate and electrical conductivity, create a galvanic couple. Significant corrosion of one of the components of this couple can occur under suitable conditions of: 1) conductive environment (i.e., salt water, acid, etc.) and 2) corrosion potential difference between the elastomer-metal couple (the difference between the Electromotive Force (EMF) values of the two materials). If the elastomer corrodes, an insulating corrosion product is formed that reduces the conductivity of the elastomer.

On the other hand, if the metal substrate corrodes, the metal loss could threaten the integrity of the flange and the corrosion products could adversely effect the performance of the elastomer. When designing the enclosure it is important to avoid conditions that can lead to significant corrosion. The following data are intended to be a guide to help in choosing the appropriate type of couple(s) so as to avoid or minimize these conditions.

Corrosion Test – To evaluate the impact of corrosion on the elastomer/metal galvanic couples test samples were exposed to 500 hours of salt spray in accordance with missile specification MIS-47057. The test fixtures were assembled as per Figure 1. The dimensions of the electrically conductive elastomer washers are shown in Figure 2 and the metal coupons are shown in Figure 3.

The volume resistivity of the elastomers and the weight of the metal coupons were measured before, and then again after the salt spray test. From this data, the change in volume resistivity for the elastomer and the weight loss for the metal coupons were calculated. With these two pieces of data it is possible to assess the compatibility of the various elastomer/metal couples. This information can then be used as a design guidance tool to determine which combinations of conductive elastomer gasket and metal flange are appropriate for a particular application. The following corrosion data indicate the performance of the galvanic couples in a very corrosive environment and thus represent a worst-case scenario.

Weight Loss of Metal Coupons (Part 1 of Galvanic Couple) — Five different metallic materials were evaluated. The five metallic materials included chromated aluminum, Galvalume® (a 55% Al-45% Zn hot-dip coated steel), tin plated steel, zinc plated steel and stainless steel (Table 1). These materials represent some of the common types of sheet metal used to manufacture enclosures.

FIGURE 1. TEST ASSEMBLY PER MIS-47057

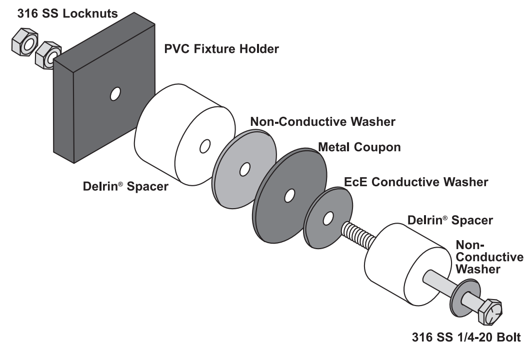


FIGURE 2. CONDUCTIVE WASHER

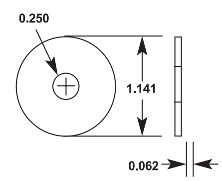
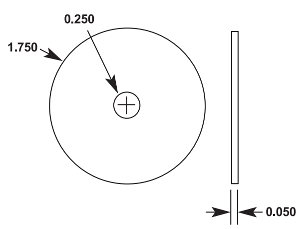


FIGURE 3. METAL COUPON



CORROSION OF EMI GASKETS

At the other extreme there were a number of elastomers in which there was only a very small percent increase in volume resistivity. In these cases, the conductive elastomer was probably the cathode or the galvanic couple had a very small corrosion potential difference. Under these conditions there was very little loss of conductivity after exposure to a corrosive environment.

Design Considerations – When choosing a conductive elastomer for a particular design, especially in a potentially corrosive environment, it is important to look at shielding requirements and the type of galvanic couple that will be created. In deciding which couple best serves the design requirements two factors will have to be considered:

1. The impact of the galvanic couple on the enclosure material (Table 3).
2. The impact of the galvanic couple on the volume resistivity of the elastomer, Graphs 1–5 on page 54.

The impact of the galvanic couple on the corrosion of the enclosure material can be gauged by the metal coupon weight loss rating on Table 3 (page 55). As the color changes, the flange area on the enclosure will experience increasing amounts of corrosion.

Metal substrate factors to consider when choosing a elastomer/metal couple:

- Allowable enclosure material(s)
- Effect of weight loss/corrosion on the function of the enclosure
- Area of exposed enclosure material close to elastomer

The impact of corrosion on the shielding effectiveness of the elastomer can be gauged by the change in volume resistivity, see Graphs 1–5 on page 47. The greater the increase in volume resistivity after exposure to a corrosive environment the greater should be the drop-off in shielding effectiveness.

Elastomer factors to consider when choosing an elastomer/metal couple:

- Shielding requirements
- Change in volume resistivity of elastomer in corrosive environments
- Environmental sealing requirements
- Required compression properties

How to Use the Charts – When deciding on a conductive elastomer, it is important to examine the potential impact of galvanic corrosion. From a corrosion standpoint, the best design is an elastomer/metal flange galvanic couple that will result in the lowest corrosion rate. The charts (Table 3 and Graphs 1–5) in this section are intended to be used as a guide for choosing the least corrosive galvanic couple (other design considerations should also be taken into account when using these charts, such as restrictions on enclosure materials and environmental sealing requirements). To arrive at the best choice(s) for a particular application the impact of corrosion on both halves of the galvanic couple must be examined. One half is the weight loss on the metal substrate and the other half is the change in volume resistivity for the elastomer. The combined effect will dictate the corrosion performance of the galvanic couple/ finished component.

In Table 3, pick out the appropriate row(s) based on the choice of the enclosure material(s) and then note the elastomer compound(s) that has the lowest metal coupon weight loss. Then go to the appropriate Graphs 1–5, based on the metal substrate(s) of choice, and find the change in volume resistivity for the elastomer compound(s) that you have just identified from Table 3.

The elastomers that have the lowest change in volume resistivity will represent the elastomer/metal substrate combination(s) that will create the least corrosive couple. If a combination of metal substrate with a very low weight loss and elastomer with a very small change in volume resistivity is not identified, then a compromise will have to be made. In that case go through the same process but, now look at metal substrates with slightly higher weight losses and/or elastomers with slightly larger changes in volume resistivity. After a candidate is selected it is always best to test the elastomer(s) in the specific application.

EXAMPLE

Assume the enclosure is aluminum.

1. From the aluminum row in Table 3, elastomer compounds #14, 89 and 96 will cause the lowest weight loss on the aluminum metal substrate.
2. From Graph 1 (Chromated Aluminum) compound #89 has the lowest change in volume resistivity and 96 is a close second (compound #14 has extremely large changes in volume resistivity).
3. As long as the elastomer matrix and initial attenuations are acceptable, choose either compound #89 or 96.

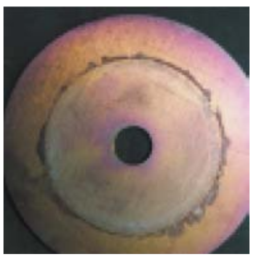
ELASTOMER GALVANIC COMPATIBILITY CHART

TABLE 3. METAL COUPON WEIGHT LOSS RATING*

COMPOUND NUMBER: ELASTOMER AND FILLER MATERIAL

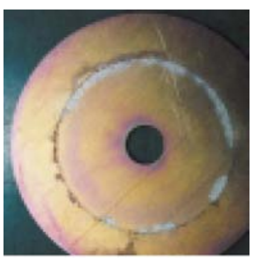
METAL SUBSTRATE	80 SIL AG/CU	81 SIL AG/AL	84 SIL AG/NI	85 SIL AG/GLASS	89 FSIL AG/AL	92 FSIL NI/ GRAPHITE	93 SIL NI/ GRAPHITE	96 EPDM AG/AL
Chromated Al	• (red)	• (purple)	• (red)	• (red)	• (orange)	• (purple)	• (purple)	• (orange)
Galvalume®	• (red)	• (purple)	• (red)	• (red)	• (teal)	• (purple)	• (purple)	• (orange)
Tin Plated Steel	• (purple)	• (orange)	• (purple)	• (teal)	• (orange)	• (teal)	• (teal)	• (orange)
Zinc Plated Steel	• (purple)	• (orange)	• (teal)	• (teal)	• (orange)	• (orange)	• (orange)	• (orange)
Stainless Steel	• (orange)	• (orange)	• (orange)	• (orange)	• (orange)	• (orange)	• (orange)	• (orange)

*This chart to be used in conjunction with Graphs 1–5 on page 54.



(orange) Little to no weight loss on metal coupon; less than 0.25%. Acceptable in all environments.

(purple) Substantial amount of weight loss on metal coupon; between 0.50% and 1.25%. Not acceptable in corrosive environments; for less corrosive applications consult with Laird Technologies applications engineer.



(teal) Moderate amount of weight loss on metal coupon; between 0.25% and 0.50%. May not be acceptable in very corrosive environments.

(red) Extreme amount of weight loss on metal coupon; greater than 1.25%. Not recommended in any environments.

Americas: +1.800.634.2673
Europe: +420.488.575277
ASEAN: +65.6243.8022
China: +86.757.2563.8860
India: +91.80.40740.400 x448
Japan: +81.45.473.6808
Korea: +82.10.8706.7469
Taiwan: +886.2.22901234 x163

www.lairdtech.com

EMI-CAT-ECE 0113