

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 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.

ELECTROSEAL CONDUCTIVE ELASTOMER

CASE STUDY

TABLE 1

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)

TABLE 2

Fluid	Silicone	Fluorosilicone	EPDM
Impermeability to Gases	Poor	Fair	Good
Ozone and Ultraviolet	Excellent	Excellent	Excellent
ASTM 1 Oil	Fair	Good	Don't Use
Hydraulic Fluids (Organic)	Fair	Good	Don't Use
Hydraulic Fluids (Phosphate ester)	Fair	Fair	Excellent
Hydrocarbon Fuels	Don't Use	Good	Don't Use
Dilute Acids	Fair	Good	Good
Concentrated Acids	Don't Use	Don't Use	Fair / Good
Dilute Bases	Fair	Good	Excellent
Concentrated Bases	Don't Use	Don't Use	Good
Esters / Ketones	Don't Use	Don't Use	Excellent
DS-2 (Decontaminating Fluid)	Poor	Poor	Good
STB (Decontaminating Fluid)	Good	Good	Good
Low Temperature	Excellent	Excellent	Excellent
High Temperature	Excellent	Good	Good
Compression Set	Good	Good	Good
Radiation Resistance	Good	Poor	Good

TABLE 3

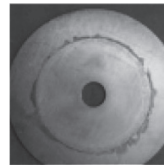
Metal Substrate	80 Sil AG/CU	81 Sil AG/AL	84 Sil AG/NI	85 Sil AG/ Glass	89 FSil AG/AL	92 FSil NI/ Graphite	93 Sil NI/ Graphite	96 EPDM AG/AL
Chromated Al	•	•	•	•	•	•	•	•
Galvalume®	•	•	•	•	•	•	•	•
Tin Plated Steel	•	•	•	•	•	•	•	•
Zinc Plated Steel	•	•	•	•	•	•	•	•
Stainless Steel	•	•	•	•	•	•	•	•

TABLE 4

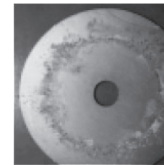
Material Thickness	Compression Force PSI (MPa) at Deflection of:			
	5%	* 10%	15%	20%
0.045 (1,1)	40 (0,3)	100 (0,7)	155 (1,1)	280 (1,9)
0.062 (1,6)	85 (0,6)	165 (1,1)	240 (1,7)	345 (2,4)
0.125 (3,2)	115 (0,8)	180 (1,2)	245 (1,7)	290 (2,0)

TABLE 5

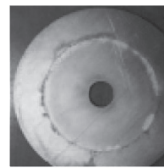
Cross Section Shape	Deflection
Flat Strip	5-10 Percent
Solid O	20-25 Percent
Solid D	15-20 Percent
Hollow O	20-50 Percent
Hollow D	25-50 Percent
Hollow P	25-50 Percent
Interference Fit	15-25 Percent



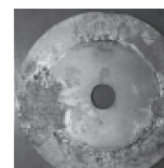
Little to no weight loss on metal coupon; less than 0.25%. Acceptable in all environments.



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 applications engineer.



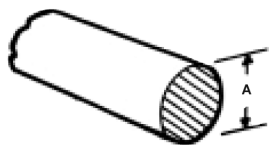
Moderate amount of weight loss on metal coupon; between 0.25% and 0.50%. May not be acceptable in very corrosive environments.



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

EXTRUSIONS GUIDE

O-Strips



MIL-DTL-85328 PART NUMBER	PART NUMBER	RECOMMENDED GROOVE DIMENSIONS (±0.002)		
		A	WIDTH	HEIGHT
	8863-0184	0.032 (0,8)	0.036 (0,9)	0.026 (0,7)
M83528/001X001	8863-0100	0.040 (1,0)	0.045 (1,1)	0.032 (0,8)
M83528/001X002	8863-0105	0.053 (1,3)	0.059 (1,5)	0.042 (1,1)
M83528/001X003	8863-0110	0.062 (1,6)	0.066 (1,7)	0.050 (1,3)
M83528/001X004	8863-0115	0.070 (1,8)	0.076 (1,9)	0.056 (1,4)
M83528/001X005	8863-0120	0.080 (2,0)	0.086 (2,2)	0.064 (1,6)
M83528/001X006	8863-0125	0.093 (2,4)	0.100 (2,5)	0.074 (1,9)
	8863-0196	0.098 (2,5)	0.105 (2,7)	0.078 (2,0)
M83528/001X007	8863-0130	0.103 (2,6)	0.110 (2,8)	0.082 (2,1)
	8863-0135	0.112 (2,8)	0.119 (3,0)	0.089 (2,3)
M83528/001X008	8863-0140	0.119 (3,0)	0.126 (3,2)	0.095 (2,4)
M83528/001X009	8863-0145	0.125 (3,2)	0.133 (3,4)	0.100 (2,5)
	8863-0150	0.130 (3,3)	0.137 (3,5)	0.104 (2,6)
M83528/001X010	8863-0160	0.139 (3,5)	0.147 (3,7)	0.111 (2,8)
	8863-0165	0.150 (3,8)	0.158 (4,0)	0.120 (3,0)
	8863-0170	0.160 (4,1)	0.168 (4,3)	0.128 (3,3)
	8863-0197	0.186 (4,7)	0.197 (5,0)	0.149 (3,8)
M83528/001X011	8863-0183	0.188 (4,8)	0.200 (5,1)	0.150 (3,8)
	8863-0198	0.194 (4,9)	0.209 (5,3)	0.156 (4,0)
	8863-0199	0.197 (5,0)	0.210 (5,3)	0.158 (4,0)
M83528/001X0012	8863-0175	0.216 (5,5)	0.229 (5,8)	0.173 (4,4)
M83528/001X013	8863-0180	0.250 (6,4)	0.267 (6,8)	0.200 (5,1)
	8863-0200	0.256 (6,5)	0.274 (7,0)	0.205 (5,2)
	8863-0201	0.312 (7,9)	0.337 (8,6)	0.250 (6,4)
	8863-0202	0.374 (9,5)	0.400 (10,2)	0.300 (7,6)