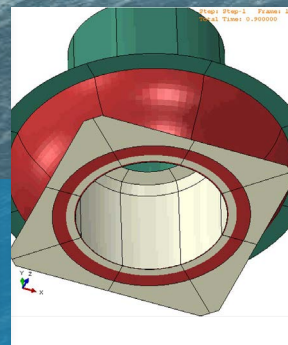
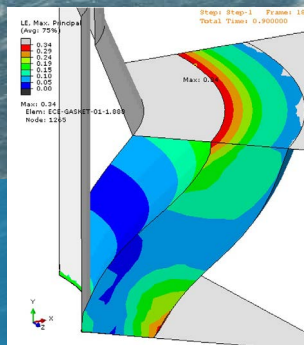
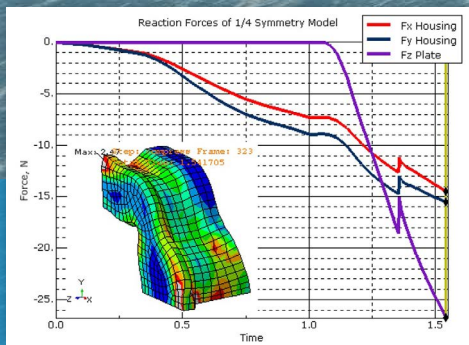


QUALITY ENGINEERED

# Sealing Gaskets

LAB FORMULATED.  
EXPERTLY TESTED.  
BATTLEFIELD PROVEN.

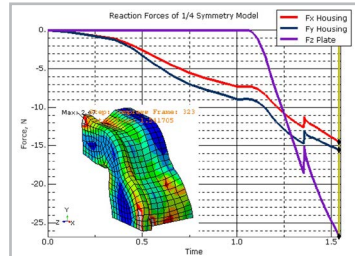


# Shielding the Warfighter and the Systems and Equipment *Delivering that Protection*

## ELECTRICALLY CONDUCTIVE ELASTOMERS FOR MIL/AERO APPLICATIONS

Electrically conductive Elastomers (EcE) consist of conductive particles dispersed into an elastomeric matrix. Once a volume of filler loading achieves the percolation threshold the elastomer itself becomes conductive, and provides a rigorous seal that shields electromagnetic interference (EMI) in all types of conditions. EcE is produced by extruding a specific profile or compression molding into a sheet or unique shape. Extruded profiles come in either a solid or hollow form factor depending on the application requirements.

EcE gaskets provide an environmental and EMI seal for electronic housings, hatches, panels, or other areas where EMI must not escape or enter. Conductive elastomers can incorporate a fabric reinforcement – either conductive or non-conductive – to enhance strength and performance. They can be co-molded with non-conductive elastomers and even with microwave absorptive elastomers for unique performance and applications.



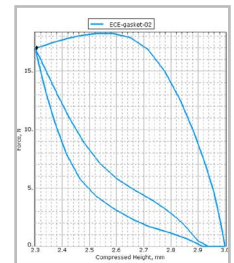
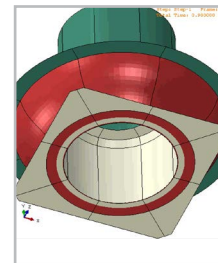
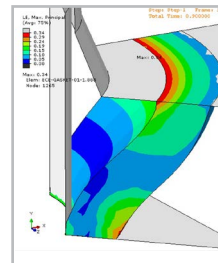
Connector seal/housing interface

is desired, applications with composite or titanium structures generally use nickel graphite fillers. Laird R&F Products helps you identify the best filler-elastomer combination for a given application.

## FORM FACTORS

A wide variety of form factors can be manufactured. Factors governing the selection of the shape include:

- **Compression requirements**
- **Gland fill requirements**
- **Closure force**
- **Other considerations; cases that require a customer molded seal**
  - External pressure and direction
  - Unique fitting requirements
  - Movement of one or both sides of the mating surfaces



Perimeter shielding of coaxial connector

## ELASTOMERS

Standard EcE includes include silicone and fluorosilicone. Silicone is used for standard applications and fluorosilicone is used when fuel resistance is required. Specialty elastomers such as EPDM and urethane are also used.

*Laird R&F Products, a DuPont company, is well-known throughout the military/aerospace industry.*

We are the leader in the development, extreme testing, and commercialization of custom electrically conductive elastomers to fit every conceivable need. We defend the defenders and the systems and equipment they rely upon.

## FILLERS

Fillers are either silver-coated base metals or nickel-coated graphite. Pure silver is rarely used due to cost and offers little enhanced performance. The base particle is generally picked for best galvanic compatibility to the mating surfaces. For instance, silver-coated aluminum is used for sealing an aluminum housing. When no silver compound

## DESIGNING CUSTOM SEALS AND GASKETS

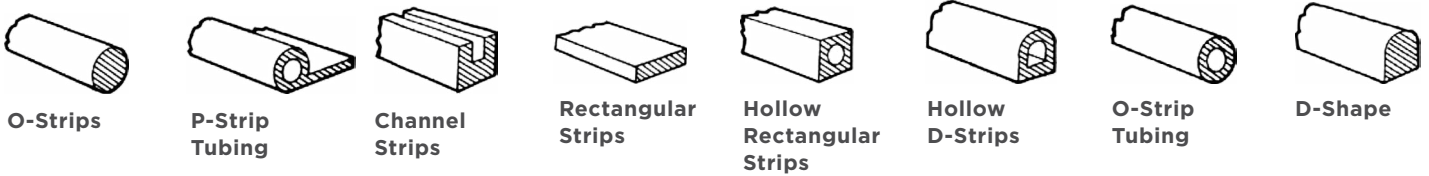
For unique applications such as vehicle exteriors, these different factors all need to be considered. Design engineers should define the requirements to allow for unique designs. Laird R&F Products has an excellent database of the mechanical properties of its materials. That allows the use of finite element analysis to design the unique solution. Laird R&F Products is a leader of using Abaqus software to design aircraft seals and gaskets and well as for ground vehicles and naval vessels.

Simulation complexity is tailored to needs: from quick early-stage design iterations to fully-realistic final design verifications, including hyperelastic material response with Mullins Effect and plastic strain, and complex boundary conditions with friction. In some cases, fluid filled cavity and pressure penetration analyses are done. Typical outputs include stress, strain, contact forces and pressure. Laird R&F Products completes in-house raw material and product testing for development of Abaqus FEA inputs and product validation.

# Compound Selection Guide:

## Standard Performance

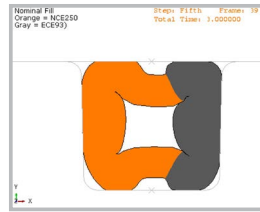
Laird R&F Products offers a series of seals and gaskets to meet a wide range of customer requirements for military and aerospace applications.



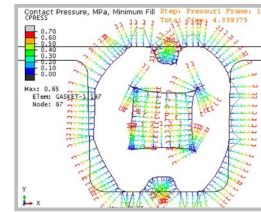
PARAMETER	TEST METHOD					
Filler		silver/Ni	Ni/graphite	silver/glass	silver/Al	silver/copper
Elastomer		silicone	silicone	silicone	silicone	silicone
NAME OF PRODUCT		EcE84	EcE93	EcE115	EcE116	EcE118
<b>ELECTRICAL PROPERTIES</b>						
Volume Resistivity, W-cm, Max	MIL-DTL-83528C para 4.5.10	0.005	0.0100	0.006	0.008	0.004
Shielding Effectiveness, 10 GHz, dB, Min	MIL-DTL-83528C para 4.5.12	100	100	100	100	120
<b>PHYSICAL PROPERTIES</b>						
Density, g/cm <sup>3</sup> (+-0.25)	ASTM D792	4.00	1.90	1.90	2.00	3.40
Hardness, Shore A (+-7)	ASTM D2240	75	55	65	65	65
Tensile Strength, psi, Min	ASTM D412	200	150	200	200	200
Elongation	ASTM D412	100-300%	100-300%	60-250%	100-300%	50-200%
Tear Strength, psi, Min	ASTM D624, die C	30	30	30	30	25
Compression Set, Max	ASTM D395	32%	30%	30%	32%	32%
Max Operating Temp., °C	MIL-DTL-83528C para 4.5.15	125	160	160	160	125
Min. Operating Temp., °C	ASTM D1329	-55	-55	-55	-55	-55
<b>ELECTRICAL STABILITY</b>						
After Heat Aging, W-cm,	MIL-DTL-83528C para 4.5.15	0.010	0.200	0.015	0.015	0.010
After Break, W-cm, Max	MIL-DTL-83528C para 4.5.9	0.010	0.200	0.009	0.015	0.008
During Vibration, W-cm, Max	MIL-DTL-83528C para 4.5.13	0.010	0.200	0.009	0.015	0.006
After Exposure to EMP, W-cm, Max	MIL-DTL-83528C para 4.5.16	0.010	0.100	0.015	0.015	0.010
Compression/Deflection, % Min	ASTM D575	3.5	8.0	3.5	3.5	3.5
Fluid Immersion	MIL-DTL-83528C para 4.5.17	NS	NS	NS	SUR	NS
<b>MANUFACTURING PROCESSES</b>						
Molded Sheets/ Die-cut Parts		x	X	x	x	x
Molded Shapes / O-rings		x	X	x	x	x
Extruded Profiles		x	X	x	x	x
Color		tan	black	tan	tan	tan
MIL-DTL-83528 Type*		L	-	M	B	A

\*Laird R&F Products' compounds meet the requirements of, but are not certified to, MIL-DTL-83528

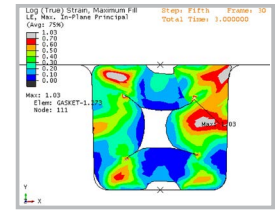
# Compound Selection Guide: High Performance



Coextruded seal at nominal groove fill



Contact pressure at minimum groove fill



True strain at maximum groove fill

PARAMETER	TEST METHOD						
Filler		Ni/graphite	silver/Al	silver/Al	Ni/graphite	silver/Al	
Elastomer		fluorosilicone	fluorosilicone	fluorosilicone	EDPM	EDPM	
NAME OF PRODUCT		EcE92	EcE126	EcE130	EcE95	EcE96	
ELECTRICAL PROPERTIES							
Volume Resistivity, W-cm, Max	MIL-DTL-83528C para 4.5.10	0.010	0.012	0.012	0.100	0.010	
Shielding Effectiveness, 10 GHz, dB, Min	MIL-DTL-83528C para 4.5.12	90	100	95	70	90	
PHYSICAL PROPERTIES							
Density, g/cm (+-0.25)	ASTM D792	2.20	2.20	2.10	2.20	2.20	
Hardness, Shore A (+-7)	ASTM D2240	75	70	75	80	80	
Tensile Strength, psi, Min	ASTM D412	150	180	200	200	200	
Elongation	ASTM D412	60-250%	60-260%	60-260%	70-260%	70-260%	
Tear Strength, psi, Min	ASTM D624, die C	40	30	35	60	60	
Compression Set, Max	ASTM D395	30%	30%	30%	40%	50%	
Max Operating Temp., °C	MIL-DTL-83528C para 4.5.15	160	160	160		160	
Min Operating Temp., °C	ASTM D1329	-55	-55	-55		-40	
ELECTRICAL STABILITY							
After Heat Aging, W-cm, Max	MIL-DTL-83528C para 4.5.15	0.200	0.015	0.015		0.010	
After Break, W-cm, Max	MIL-DTL-83528C para 4.5.9	0.200	0.015	0.015		0.015	
During Vibration, W-cm, Max	MIL-DTL-83528C para 4.5.13	0.200	0.015	0.015		0.012	
After Exposure to EMP, W-cm, Max	MIL-DTL-83528C para 4.5.16	0.100	0.015	0.015		0.010	
Compression/Deflection, %, Min	ASTM D575	5.0	3.0	3.0	3.0	3.5	
Fluid Immersion	MIL-DTL-83528C para 4.5.17	SUR	SUR	SUR	NS	NS	
MANUFACTURING PROCESSES							
Molded sheets/ Die-cut Parts		x	x	x	x	x	
Molded Shapes/O-rings		x	x	x	x	x	
Extruded Profiles		x	x	x	x	x	
Color		dk gray	blue	tan	black	tan	
MIL-DTL-83528 Type*		-	D	D (passivated)	-	-	

\*Laird R&F Products' compounds meet the requirements of, but are not certified to, MIL-DTL-83528



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