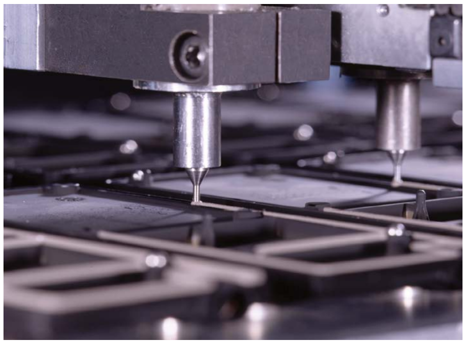
Form-In-Place CHOFORM® Robotically Dispensed EMI Gaskets

Parker Chomerics

ENGINEERING YOUR SUCCESS.

Form-In-Place (FIP) EMI Shielding and Non-Conductive Gaskets

Parker Chomerics CHOFORM Automated Form-In-Place EMI Gaskets are ideal for today's densely populated electronics packaging, particularly where intercompartmental isolation is required to separate processing and signal generating functions. CHOFORM is directly dispensed on metal castings, machined metal and electrically conductive plastic housings and board shields utilizing programmable 3-axis dispensing and creates a secure bond during the curing process.



CHOFORM also provides excellent electrical contact to mating conductive surfaces including printed circuit board traces and is widely used in compartmentalized enclosures and other tightly packaged electronic devices in defense, telecom, automotive, transportation, aerospace and life science applications.

The CHOFORM technology allows dispensing of precisely positioned, conformable gaskets in very small cross sections that free valuable package space. CHOFORM provides the lowest total cost of ownership for small cross section and complex pattern applications and can reduce installed cost of an EMI gasket by up to 60%. These durable, highly conductive seals have low compression set, ensuring years of effective EMI shielding and mechanical performance.

Automated dispensing primarily permits rapid prototyping, changes in design, and production scale-up at a relatively nominal cost. Its inherent flexibility accommodates batch runs or continuous production, from ten to ten million parts. Wide acceptance of the CHOFORM dispensing system can be attributed to a successful blend of manufacturing and materials expertise.

The CHOFORM technology combined with a Parker Chomerics supplied metal or electrically conductive plastic housing or board shield provides an integrated solution ready for your highest level of assembly. Individual compartment shielding or grounding is often enhanced by placement of a secondary EMI shielding product such as a short length of metal fingerstock, fabric over foam gasket, electrically conductive extrusion gasket or even a microwave absorber.

Thermal transfer from the printed circuit boards' heat generating devices to a metal housing wall or board shield can be accomplished by placement of a soft thermally conductive gap filler or dispensed thermal compound or gel.

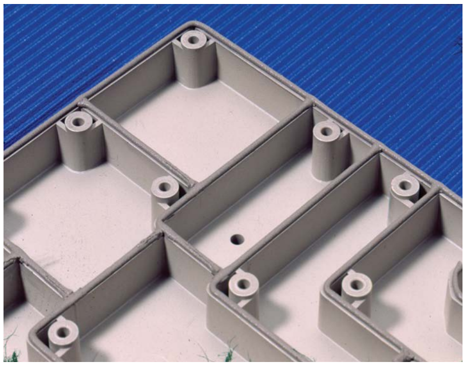
Parker Chomerics has the technology to support all these application needs in a single integrated solution. Contact Parker Chomerics for further details and assistance.

CHOFORM Form-In-Place EMI Gasket Features:

- Up to 60% space saved – flanges as narrow as 0.025 in (0.76 mm) can be gasketed.
- Achieve more than 100 dB shielding effectiveness from 200 MHz to 12 GHz with very small gasket beads.
- Excellent adhesion to common housing substrates and coatings.
- Highly compressible gaskets, ideal with limited deflection force.
- Quick turn-around of prototypes and samples. Parts are typically prototyped and shipped within several days and typically do not require tooling.

Excellent Shielding Effectiveness

Even in small cross sections, shielding effectiveness of CHOFORM gaskets exceeds 100 dB between 200 MHz and 12 GHz. Shielding performance increases with cross sectional dimensions. Results shown for various CHOFORM materials were obtained using Parker Chomerics standard bead size of 0.034 in (0.86 mm) high by 0.040 in (1.0 mm) wide.



Denser Packaging is Possible

CHOFORM gaskets can be applied to walls or flanges as narrow as 0.025 in (0.76 mm), and do not require mechanical retention. Compared with groove and friction-fit designs, the positional accuracy and self-adhesive properties of CHOFORM gaskets will typically save 60% or more space. This frees additional board space and allows for smaller overall package dimensions.

Small Cross Sections, Complex Geometries

Virtually any gasket bead path can be programmed using CHOFORM application technology. In addition to simple straight lengths, the system applies continuous 360° perimeter gaskets in combination with any required number of internal sub paths that form "T" joints with the perimeter seal. The system produces reliable junctions between bead paths that provide continuous EMI shielding and environmental sealing.

Low Closure Force Not a Problem

CHOFORM gasket materials are ideal for low deflection force designs, or those whose mating surfaces have low mechanical rigidity. Nominal deflection of 30% using a mechanical compression stop is recommended. Deflection below 20% or above 40% is not recommended. An example of typical compression-deflection data for CHOFORM materials appears in Graph 7-1.

Secure Gasket Adhesion

CHOFORM gaskets typically exhibit 4-12 N/cm of shear adhesion to a variety of common housing substrates, including:

- Cast aluminum, magnesium or zinc alloys with various such as CrO4, black chrome, black nickel, bright nickel, or tin
- Nickel-copper plating on plastic stainless steel (300 series)
- Parker Chomerics CHO-SHIELD Electrically Conductive Coatings
- Vacuum metallized aluminum

Gasket application to sloped surfaces is fully programmable

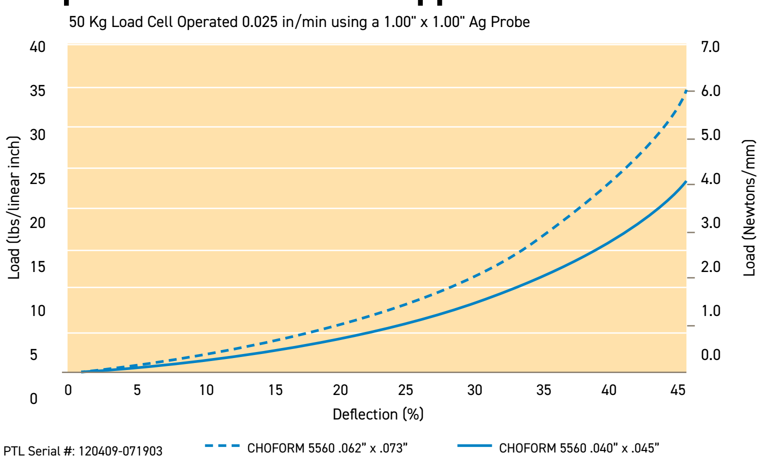
Gasket Application is Fully Programmable in 3 Axes

Full 3-axis motion of the CHOFORM application technology accommodates uneven surfaces (with a maximum slope of 60° common in castings or injection-molded parts. The result is enhanced control of the gasket cross section.

Tight Dimensional Control and Terminations

CHOFORM gasket beads are dispensed with a positional accuracy of 0.001 in (0.025 mm), and a height tolerance of ±0.004 in (0.15 mm) for beads with cross-sections less than or equal to .034 in (0.86 mm) and a tolerance of ±0.006 in (0.10 mm) for beads with larger than .034 in (0.86 mm). This innovative technology produces clean bead ends minimizing the "tail" characteristic of other processes. The key is precise management of flow rate of material through the nozzle, material viscosity and dispensing speed.

Graph 7-1 Deflection vs. Applied Load



High Levels of Quality Control

Parker Chomerics has the capability to perform automated dimensional verification of gasket bead placement and height for statistical process control, using fully programmable optical coordinate measuring technology and vision systems. Electrical resistance of cured gasket material is tested with a multimeter capable of measuring to 0.001 ohm. Typical Cp and Cpk values are approximately 1.5.

Corrosion Resistance

CHOFORM nickel-plated aluminum (Ni/Al) filled materials have been proven after long-term aging tests to simultaneously provide the best corrosion resistance (per CHO-TM101), and the highest degree of shielding effectiveness (per CHO-TP09/IEEE STD 299) of any EMI shielding form-in-place material. Ni/Al particles have also proven to have a lower transfer impedance (per CHO-TM-TP10/SAE ARP 1705) than electrically conductive form-in-place gaskets comprised of other fillers.

Please refer to Section 2 of the Parker Chomerics Conductive Elastomer Engineering Handbook for further detail on corrosion resistance and how to help prevent galvanic corrosion in your electronics enclosure. Graph 7-2 details the weight loss of a 6061 Aluminum, Trivalent Class 3 coupon simulating an enclosure after 504 hours of salt fog exposure. CHOFORM 5560 Ni/Al performed the best with only 17 mg weight loss, compared to CHOFORM 5550 Ni/C with 106.7 mg weight loss.

A Choice of Materials Formulated for Automated Dispensing

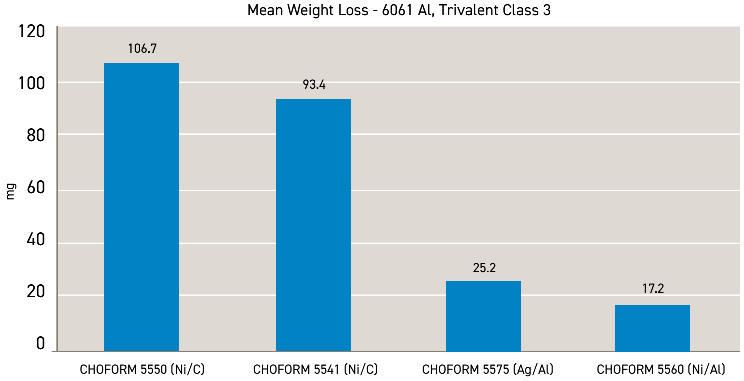
CHOFORM materials typically establish 4 to 12 N/cm adhesion to many substrates, including magnesium and aluminum alloys and commonly used conductive films such as Ni/Cu plating, vacuum metallized coatings, and conductive paints. All CHOFORM materials are durable, conformable gaskets, and can be applied as small as 0.025 in (0.64 mm) high by 0.040 in (1.0 mm) wide, delivering Cpk values >1.33.

(Exception: CHOFORM 5560 has a minimum applied height of 0.039 in high and 0.045 in wide (0.99 mm high and 1.14 mm wide). Refer to Table 7-4 for typical properties of CHOFORM materials for all minimum and maximum bead sizes.

Table 7-1 CHOFORM Form-In-Place Products At a Glance

	Features - Based on MIL-DTL-5541 Type I, Class 3 chemical conversion coating on 6061-T6 aluminum (corrosion data based on 168 hour salt fog testing)	**Conductive Filler**	**Cure Type**	**Shielding Effectiveness (200 MHz - 12 GHz, avg.)**	**Number of Components**	**Storage Conditions**
CHOFORM 5513	Excellent electrical properties and adhesion	Ag/Cu	Thermal	>70 dB	2	Frozen @ -10°C +/- 5°C
CHOFORM 5541	Corrosion resistant, excellent adhesion	Ni/Graphite	Thermal	>65 dB	1	Frozen @ -10°C +/- 5°C
CHOFORM 5550	Good corrosion resistance, good adhesion, low closure force	Ni/Graphite	Thermal	>65 dB	1	Frozen @ -10°C +/- 5°C
CHOFORM 5560	Excellent corrosion resistance	Ni/Al	Thermal	>90 dB	1	Frozen @ -10°C +/- 5°C
CHOFORM 5526	Lowest resistance for excellent grounding and shielding, good adhesion	Ag	Moisture	>90 dB	1	Room temp. @ 22°C +/- 5°C
CHOFORM 5528	Excellent electrical properties	Ag/Cu	Moisture	>70 dB	1	Room temp. @ 22°C +/- 5°C
CHOFORM 5538	Good adhesion and good corrosion resistance. Small bead cross section	Ni/Graphite	Moisture	>50 dB	1	Room temp. @ 22°C +/- 5°C
CHOFORM 5575	Excellent corrosion resistance and good adhesion	Ag/Al	Moisture	>80 dB	1	Room temp. @ 22°C +/- 5°C

Graph 7-2 CHOFORM Products After 504 hrs of Salt Fog Exposure



ParPHorm Automated Form-In-Place Non-Conductive Gaskets

While CHOFORM form-in-place gaskets are electrically conductive, ParPHorm is a family of non-conductive thermal and moisture-cure form-in-place elastomeric sealing compounds. Available in either silicone and fluorosilicone versions, these materials provide environmental, fluid, and dust sealing of small enclosures.

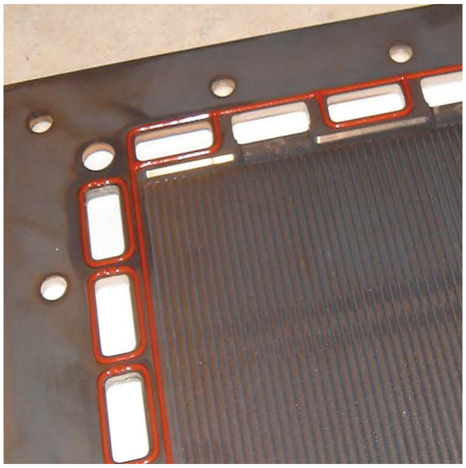
The ParPHorm product line consists of state-of-the art compounds designed to be robotically dispensed onto small housings and then cured. Curing of the L1938 dispensed materials is done via in-line ovens at 284°F (140°C) for 30 minutes. Dispensed bead heights range from 0.018 in (0.46 mm) to 0.062 in (1.57 mm). Application advantages of the materials are resistance to a wide variety of fluids, excellent substrate adhesion, low hardness, and outstanding compression set properties. Refer to Table 7-4.

Thermal Cure Material

ParPHorm L1938 is a fluorosilicone FIP elastomer with a typical Shore A hardness of 45 and compression set rating of 14% after 70 hrs at 158°F (70°C). This fluorosilicone material offers additional fluid resistance capabilities above and beyond the capabilities of silicone-based ParPHorm 1800.

ParPHorm L1938 Material Features

- One component fluorosilicone thermal cure material
- Excellent resistance to a wide variety of fluids
- Excellent adhesion to a wide variety of substrates
- Low material and installation costs



Handling and Curing of ParPHorm L1938

ParPHorm L1938 is a single component fluorosilicone, thermal cure material. Recommended cure temperature is 284°F (140°C) for 30 minutes. The full cure cycle of 30 minutes allows for immediate handling, and performance of necessary QC tests. The use of this thermal cure, form-in-place material reduces the need for dispensed parts storage space. This also allows for immediate packaging and shipment of parts to their final destination for subsequent integration into the equipment assembly process.

Moisture Cure Material

ParPHorm 1800 is a non-conductive, moisture-cure, form-in-place (FIP), silicone elastomer sealing material. The material provides environmental, fluid, and dust sealing of small enclosures via a compound designed to be robotically dispensed onto small housings. Curing of the dispensed material is via moisture cure for 24 hours. Minimum bead size is 0.018 in (0.46 mm) tall by 0.022 in (0.56 mm) wide. Maximum bead size is 0.050 in (1.27 mm) tall by 0.063 in (1.60 mm) wide.

ParPHorm 1800 Application Advantages

- Excellent adhesion
- Low hardness
- Excellent compression set properties

Applications for ParPHorm 1800 material include handheld electronic module housings, battery cases, industrial gauges, fuel cells, and other enclosures requiring small dispensed elastomer seals for environmental or fluid sealing.

ParPHorm 1800 Material Features

- One component moisture-cure material
- Excellent resistance to a wide variety of fluids
- Excellent adhesion to a wide variety of substrates
- Low material and installation costs

Handling and Curing of ParPHorm 1800

Recommended cure condition is 22°C, 50% RH for 24 hours. For these same temperature and humidity conditions the tack-free time is approximately 18 minutes and handling time is four hours.

ParPHorm S1945 (Discontinued)

Parker Chomerics offers ParPHorm 1800 Non-Conductive Form-in-Place Sealing Compound (silicone) and ParPHorm L1938 Non-Conductive Form-in-Place Sealing Compound (fluorosilicone) materials as possible replacement materials for the discontinued ParPHorm S1945 material.

Design and Prototyping

Application and design assistance is available to help focus on examining and identifying design issues regarding the substrate. These design issues include enclosure material and surface finish, available gasket placement area, material selection, part flatness, transitions in the layout of the dispensed bead, obstructions in the design of the enclosure to the unimpeded travel of the dispense needle, and Z-direction dispense needs. Prototype dispensing is available on sample parts or sample coupons for customer evaluation.

Material Dispensing

CHOFORM and ParPHorm materials are easily dispensed from a variety of commercially available gasket dispense systems. In addition to the Parker Chomerics existing worldwide network of CHOFORM applicators, the CHOFORM Applications Engineering team can provide support for material dispense needs worldwide for customers wishing to utilize their own or other dispense equipment.

Table 7-2 CHOFORM Ordering Information

SELECTED OVERMOLDED CONDUCTIVE ELASTOMER SPECIFICATIONS			
Material	**Part Number**	**Material Weight**	**Packaging Type = Size**
5513	19-26-5513-0850	Part A - 450 grams Part B - 475 grams	Part A - 6 fl. oz. SEMCO Tube Part B - 6 fl. oz. SEMCO Tube
5526	19-26-5526-0850	850 grams	12 fl. oz. Aluminum Cartridge
5528	19-26-5528-0850	850 grams	12 fl. oz. Aluminum Cartridge
5538	19-26-5538-0650	650 grams	12 fl. oz. Aluminum Cartridge
5541	19-26-5541-0650	650 grams	12 fl. oz. Aluminum Cartridge
5550	19-26-5550-0575	575 grams	12 fl. oz. Aluminum Cartridge
5560	19-26-5560-0500	500 grams	12 fl. oz. Aluminum Cartridge
5575	19-26-5575-0240 19-26-5575-0500	240 grams 500 grams	6 fl. oz. SEMCO Tube 12 fl. oz. Aluminum Cartridge

Samples typically provided in 30cc syringes

Table 7-3 ParPHorm Ordering Information

Material	Part Number	Material Weight	Packaging Type = Size
1800	19-26-1800-0345	345 grams	12 fl. oz. Aluminum Cartridge
1938	19-26-1938-0200	200 grams	6 fl. oz. SEMCO Tube

Table 7-4 Form-In-Place Selector Guide

CHOFORM® - Conductive Form-In-Place Gaskets						
Typical Properties	**Test Procedure**	**Units**	**CHOFORM® 5513**	**CHOFORM® 5541**	**CHOFORM® 5550**	**CHOFORM® 5560**
Features - Based on MIL-DTL-5541 Type I, Class 3 chemical conversion coating on 6061-T6 aluminum (corrosion data based on 168 hour salt fog testing)	--	--	Excellent electrical properties and adhesion	Corrosion resistant, excellent adhesion	Good corrosion resistance, good adhesion, low closure force	Excellent corrosion resistance
Conductive Filler	--	--	Ag/Cu	Ni/C	Ni/C	Ni/Al
Polymer System	--	--	Silicone	Silicone	Silicone	Silicone
Number of Components	--	--	2	1	1	1
Cure System	--	--	Thermal	Thermal	Thermal	Thermal
Cure Schedule Tack Free Time Handling Time Full Cure Alternative Full Cure	--	--	30 mins @ 140˚C 30 mins @ 140˚C 30 mins @ 140˚C	30 mins @ 150˚C 30 mins @ 150˚C 30 mins @ 150˚C	30 mins @ 150˚C 30 mins @ 150˚C 30 mins @ 150˚C 10 ± 5 mins @ 200˚C	30 mins @ 150˚C 30 mins @ 150˚C 30 mins @ 150˚C 10 ± 5 mins @ 200˚C
Hardness	ASTM D2240 (C)	Shore A	53	75	55	55
Tensile Strength	ASTM D412 (C)	psi	350	500	175	165
Specific Gravity	ASTM D792 (C)	--	3.4	2.4	2.1	1.8
Volume Resistivity	Chomerics MAT-1002 (C)	Ω-cm	0.004	0.030	0.035	0.13
Galvanic Corrosion Resistance Against Chem Filled Aluminum	Chomerics TM-100	Weight Loss mg	NR	32	20	4
*Compression Set 22 hrs @ 85˚C	ASTM D395 Method B (C)	%	28	30	25	25
Maximum Use Temp	--	˚C (˚F)	125 (257)	125 (257)	125 (257)	125 (257)
Flammability Rating - Tested internally by Chomerics	UL 94	--	V-0	V-0	V-0	V-0
Shielding Effectiveness (avg 200 MHz - 12 GHz)	Modified IEEE-299	dB	>70	>65	>65	>90
Adhesion Trivalent Chromate Coating on Alum	Chomerics WI 038	N/cm	20	25	12	6
Force Deflection @ 30% Compression 0.034" x 0.040" sized bead (0.86 mm x 1.02 mm) English Metric	 ASTM D575 Mod ASTM D575 Mod	 lb-f/in N/cm	 6 11	 16 28	 6 11	 8 14
Bead Size** Smallest Recommended Largest Recommended (single pass)	 Height by Width Height by Width	 inches (mm) inches (mm)	 0.018 x 0.022 (0.46 x 0.56) 0.062 x 0.075 (1.57 x 1.91)	 0.026 x 0.032 (0.66 x 0.81) 0.059 x 0.070 (1.50 x 1.80)	 0.038 x 0.045 (0.96 x 1.14) 0.062 x 0.075 (1.57 x 1.91)	 0.038 x 0.045 (0.96 x 1.14) 0.062 x 0.075 (1.57 x 1.91)
Shelf Life (bulk material) from Date of Manufacture	Chomerics	Months	6			
Storage Conditions	Chomerics	˚C (˚F)	Store in Freezer at -10˚C ± 5 (14˚F ± 9)			

*Compression set is expressed as a percentage of deflection per ASTM D395 Method B., at 25% deflection. To determine percent recovery, subtract 1/4 of stated compression set value from 100%. For example, in the case of 30% compression set, recovery is 92.5%.

**Recommended bead size determined by Chomerics standard pneumatic equipment and off the shelf dispensing needles.

Note: NR - Not Recommended, NA - Not Applicable See Chomerics for product specifications if needed
(C) Conformance Property

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.

Cure System Legend

Moisture Cure	Thermal Cure

Table 7-4 Form-In-Place Selector Guide continued

CHOFORM® - Conductive Form-In-Place Gaskets						
Typical Properties	**Test Procedure**	**Units**	**CHOFORM® 5575**	**CHOFORM® 5526**	**CHOFORM® 5528**	**CHOFORM® 5538**
Features - Based on MIL-DTL-5541 Type I, Class 3 chemical conversion coating on 6061-T6 aluminum (corrosion data based on 168 hour salt fog testing)	--	--	Excellent corrosion resistance and good adhesion	Lowest resistance for excellent grounding and shielding, good adhesion	Excellent electrical properties	Good adhesion and good corrosion resistance. Small bead cross section
Conductive Filler	--	--	Ag/Al	Ag	Ag/Cu	Ni/C
Polymer System	--	--	Silicone	Silicone	Silicone	Silicone
Number of Components	--	--	1	1	1	1
Cure System	--	--	Moisture	Moisture	Moisture	Moisture
Cure Schedule Tack Free Time Handling Time Full Cure	--	--	18 mins @ 22˚ C & 50% RH 4 hours @ 22˚ C & 50% RH 24 hours @ 22˚ C & 50% RH	18 mins @ 22˚ C & 50% RH 4 hours @ 22˚ C & 50% RH 24 hours @ 22˚ C & 50% RH	18 mins @ 22˚ C & 50% RH 4 hours @ 22˚ C & 50% RH 24 hours @ 22˚ C & 50% RH	18 mins @ 22˚ C & 50% RH 4 hours @ 22˚ C & 50% RH 4 hours @ 22˚ C & 50% RH
Hardness	ASTM D2240 (C)	Shore A	75	38	40	65
Tensile Strength	ASTM D412 (C)	psi	180	80	125	325
Specific Gravity	ASTM D792 (C)	--	1.9	3.4	3.1	2.2
Volume Resistivity	Chomerics MAT-1002 (C)	Ω-cm	0.010	0.003	0.005	0.050
Galvanic Corrosion Resistance Against Chem Filled Aluminum	Chomerics TM-100	Weight Loss mg	4	NR	NR	10
*Compression Set 22 hrs @ 85˚ C	ASTM D395 Method B (C)	%	40	45	45	45
Maximum Use Temp	--	˚C (˚F)	125 (257)	85 (185)	125 (257)	85 (185)
Flammability Rating - Tested internally by Chomerics	UL 94	--	V-0	V-0	V-0	V-0
Shielding Effectiveness (avg 200 MHz - 12 GHz)	Modified IEEE-299	dB	>80	>90	>70	>50
Adhesion Trivalent Chromate Coating on Alum	Chomerics WI 038	N/cm	10	9	4	9
Force Deflection @ 30% Compression 0.034" x 0.040" sized bead (0.86 mm x 1.02 mm) English Metric	ASTM D575 Mod	lb-f/in N/cm	14 25	15 26	8 14	13 23
Bead Size** Smallest Recommended Largest Recommended (single pass)	Height by Width Height by Width	inches (mm) inches (mm)	0.034 x 0.040 (0.86 x 1.07) 0.050 x 0.065 (1.27 x 1.65)	0.018 x 0.022 (0.46 x 0.56) 0.042 x 0.049 (1.07 x 1.24)	0.018 x 0.022 (0.46 x 0.56) 0.039 x 0.052 (1.00x1.32)	0.015 x 0.020 (0.38 x 0.51) 0.030 x 0.034 (0.76 x 0.86)
Shelf Life (bulk material) from Date of Manufacture	Chomerics	Months	5	6	6	5
Storage Conditions	Chomerics	˚C (˚F)	Room Temp. 22˚ C ± 5 (72˚ F ± 9)			

*Compression set is expressed as a percentage of deflection per ASTM D395 Method B., at 25% deflection. To determine percent recovery, subtract 1/4 of stated compression set value from 100%. For example, in the case of 30% compression set, recovery is 92.5%.

**Recommended bead size determined by Chomerics standard pneumatic equipment and off the shelf dispensing needles.

Note: NR - Not Recommended, NA - Not Applicable See Chomerics for product specifications if needed
(C) Conformance Property

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.

Cure System Legend
Moisture Cure
Thermal Cure

Table 7-4 Form-In-Place Selector Guide continued

ParPHorm - Non-Conductive Form-In-Place Gaskets				
Typical Properties	**Test Procedure**	**Units**	**ParPHorm® 1800**	**ParPHorm® L1938**
Hardness	ASTM D2240	Shore A	20	45
Tensile Strength	ASTM D412	(min.) (psi)	150	616
Elongation	ASTM D412	%	650	271
Specific Gravity	ASTM D792	--	1.4	1.24
Compression Set 70 hrs., 25% deflection @ 212° F (100° C) 70 hrs. @ 158° F (70° C) 2000 hrs. @ Room Temp 2000 hrs. @ 158° F (70° C)	ASTM D395 Method B	%	35 -- -- --	29 14 29 --
Cure System	--	--	Moisture	Thermal
Cure Schedule Tack Free Time Handling Time Full Cure	--	--	18 mins @ 22° C & 50% RH 4 hours @ 22° C & 50% RH 24 hours @ 22° C & 50% RH	30 mins @ 140° C 30 mins @ 140° C 30 mins @ 140° C
Resin System	--	--	Silicone	Fluorosilicone
Bead Size Smallest Recommended Largest Recommended (single pass)	Height by Width Height by Width	inches (mm) inches (mm)	0.018 x 0.022 (0.46 x 0.56) 0.050 x 0.063 (1.27 x 1.60)	0.018 x 0.022 (0.46 x 0.56) 0.050 x 0.063 (1.27 x 1.60)
Shelf Life (bulk material) from Date of Manufacture	Chomerics	Months	4	6
Storage Conditions	Chomerics	°C (°F)	Room Temp. 21° C ± 5 (70° F ± 9)	Store in Freezer at -10° C ± 5 (14° F ± 9)

Optimizing the Design of CHOFORM Shielded Housing Assemblies

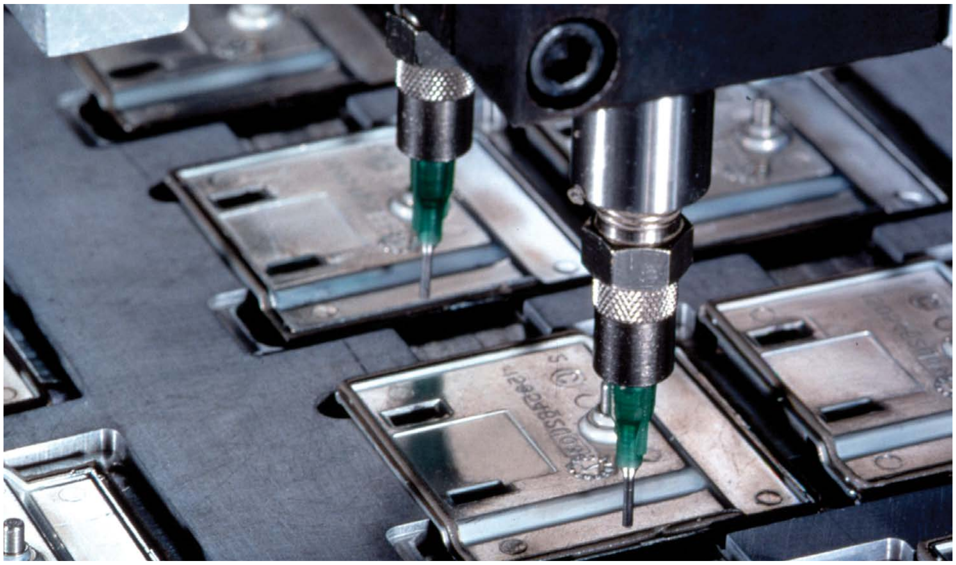
Important Considerations for Optimizing Quality and Production Efficiency

A shielded housing is an assembly whose quality and performance are functions of all the parts and processes used to produce it.

Whenever possible, Parker Chomerics interfaces on behalf of OEM customers with suppliers of die-cast metal and injection-molded plastic housings in advance of tool design and production. Detailed guidance is provided on part and tool design, part reproducibility, locating features, tolerances, and surface conditions—issues that are key to the quality and economics of robotic gasket dispensing.

Parker Chomerics can act as lead vendor, managing the entire housing supply chain to ensure the best results for OEM customers.

The following section provides answers to commonly asked questions and highlights critical design issues that affect production efficiency and cost.



Housing Material Considerations

Plastic Substrate Selection
If the housing is an injection-molded thermoplastic, the gasket cure temperature is an important parameter. Different thermoplastics soften or stress-relieve at different temperatures.

Surface Preparation
Metal or plastic surfaces to be gasketed with CHOFORM materials should exhibit electrical surface resistance of <0.01 ohm. They should be clean and free of dirt, oils and organic solvents.

Metallic housings must be treated to remove release agents and machining oils. Aluminum parts should be chromate conversion coated (alodine or irridite) per MIL-DTL-5541 Class 3. Magnesium parts should be protected with Dow 20 modified chrome pickle or equivalent.

Plastic housings require metallizing, which may be accomplished by plating, aluminum vacuum deposition or conductive paint. For plating, nickel-copper is preferred. It adheres well, provides 80+ dB of shielding effectiveness, and remains electrically stable over time. If vacuum deposition is chosen, a nitrogen purge is mandatory to ensure good adhesion.

Differences in commercially available conductive paints necessitate testing them with the selected CHOFORM gasketing material. Parker Chomerics CHO-SHIELD 2056, 610, 2040 and 2044 conductive coatings have been formulated to adhere well and be galvanically compatible with CHOFORM materials. The superior performance and batch-to-batch uniformity of these paints have been extensively demonstrated in these applications. Their high abrasion resistance provides protection during product assembly and use.

Protective Packaging

To avoid cosmetic injuries such as surface scratches, parts should be shipped in compartmentalized plastic or corrugated paper trays. If requested, Parker Chomerics will arrange for specialized packaging to be delivered to the housing manufacturer.

Gasket Design Considerations

Start/Stop Bead Profiles

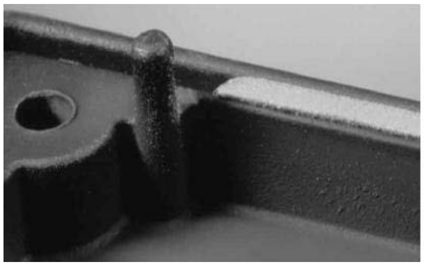
Designers should anticipate slight differences in gasket bead cross section in the start/stop zones compared with the very uniform profile produced during steady-state dispensing of straight runs.

Figures 7-1 to 7-4 illustrate the nature of these intrinsic differences and the adjusted tolerances in the initiation and termination zones, which are defined as 0.100 in (2.54 mm) long. Engineering drawings should reflect a less well-defined gasket profile in start/stop zones, to facilitate quality control inspections of incoming parts.

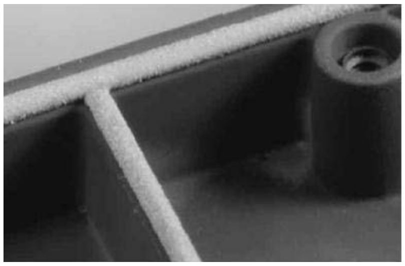
Suggested drawing references appear in Figures 7-2 and 7-3. In programming the dispense path, enough flexibility exists to minimize the number of start/stop events and to locate such events where the gasket profile is not critical.

Part drawings should identify any areas in which the increased cross section tolerances associated with start/stop zones would create a problem.

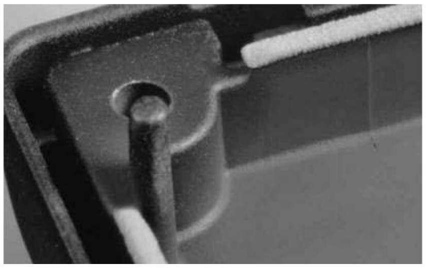
Figure 7-1 Characteristic appearance of start/stop events



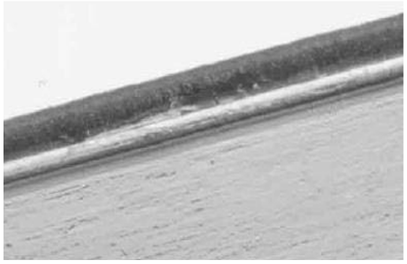
Starting event



"T" stop



Full circle perimeter stop



Straight run stop

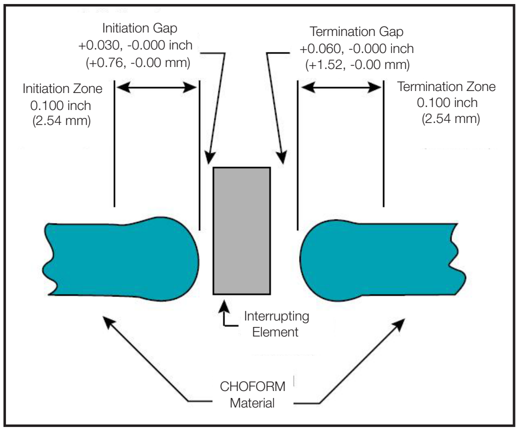


Figure 7-2 Top View Location tolerances for bead initiation & termination zones (cross-sectional view)

Figure 7-3 Side View Gasket height tolerances

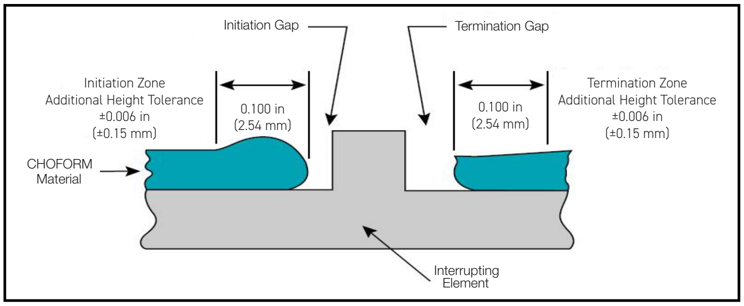
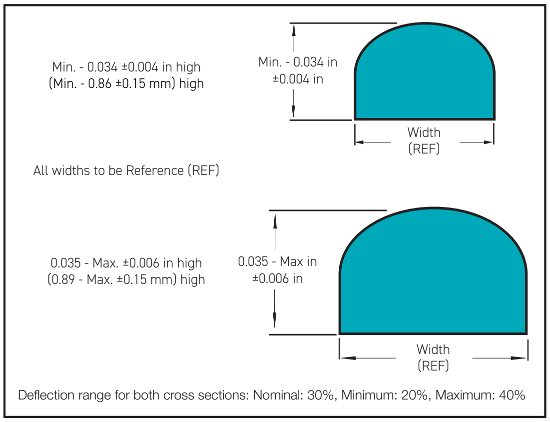


Figure 7-4 Suggested cross sections with height-to-width ratio of 0.85



Robotically Dispensed Form-In-Place EMI Gasketing

Critical Housing Design Issues

CHOFORM FIP gasket technology accommodates a reasonable degree of variability in housing part dimensions. However, setup and dispensing speed are directly impacted by part uniformity. In addition, the housing design can pose obstacles to efficient gasket dispensing.

The most common avoidable problem is warped or non-uniform housings. If housings are not sufficiently flat and dimensionally uniform, they must be restrained by special alignment and hold-down fixtures, which can add substantial setup time. For best results and production economics, designs should reflect the following considerations:

Positive Locating Features

Speed Production

Parts should be easily fixtured for fast, accurate dispensing. Reproducible positioning of the parts beneath the dispensing head is fundamental to this automated technology. Maximum production speed can be achieved when through-holes are available to pin-position parts on the pallets that transport them to the dispensing head. If through-holes are not available, two sides can be pushed against pallet rails for positioning.

This requires hold-down clamps that must be positioned without interfering with the dispensing needle.

Avoid features that complicate design of a locating system. Parting lines in dies or molds can interfere with the establishment of a locating edge. Mold gates, runners or flash can interfere with positioning pins or fixtures.

Part Reproducibility is Critical

Flanges, rails or ribs to be gasketed should have part-to-part location reproducibility (X and Y dimensions) within 0.008 in (0.20 mm). Once the dispense path is programmed, all surfaces to be gasketed must be located where the program assumes them to be. Variation greater than 0.008 in (0.203 mm) will result in gasket beads dispensed partly on and partly off the intended surfaces.

Wall heights must be reproducible in the Z-axis within 0.012 in (0.30 mm). Manufacturing processes for die-cast metal and injection molded plastic housings generally can produce parts with intrinsically reproducible, uniform dimensions in the Z-axis.

Several factors determine the gasket bead profile — air pressure in the needle, material viscosity, needle diameter, feed rate and needle height (Z) above the part. Accurate Z-axis programming is central to dispensing an optimum gasket profile.

Full 3-axis programmability of the CHOFORM dispensing heads is an important advantage in accommodating the necessary tolerances on the Z-axis position of the surface to be gasketed.

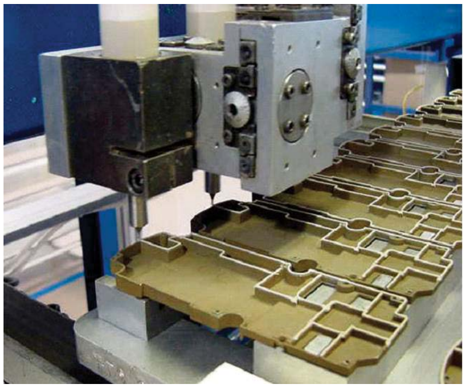
Selection of a housing supplier able to meet the reproducibility requirements for the Z-axis can make a real difference in the quality, speed and economics of gasket dispensing.

Production housing functions as master. The CHOFORM gasket dispensing head is programmed in three axes by plotting the path which the needle will follow, using a representative production housing as the master. Programming can account for unintended but consistent deviations in elevation, such as:

- non-parallelism
- non-flatness
- warping

These elevation deviations must be consistent from part to part within 0.012 in (0.30 mm). If not, special mechanical restraint fixturing will be required to ensure accurate gasket dispensing. Fixturing schemes usually entail delay and expense and may also impact production speed.

Parallelism to a defined plane. Using one or more specific part features for locating purposes, housings are mounted on a machined pallet and conveyed to the dispensing head. The pallet surface



defines the “datum plane” for Z-axis motion of the dispensing needle.

CHOFORM gaskets can be dispensed onto a part surface of known slope with respect to the datum plane (recommended up to 60°). Application onto a flat surface (i.e., 0° slope) can be more difficult than application to a sloped surface if part thickness is not consistent. Variation in overall part thickness will cause the surface to be gasketed to be non-parallel with the datum plane. Z-axis adjustments to the needle’s path are programmed using the representative master part. However, these variations must be consistent in both location and degree, and within the 0.012 in (0.30 mm) aggregate allowable tolerance to avoid the need for special fixturing. (Figures 7-5a and 7-5b.)

Flatness of the surface to be gasketed. Unevenness in flanges, rails, or ribs to be gasketed can be programmed into the Z-axis motion of the dispensing head. Again, this Z-axis variation must be consistent from part-to-part within the 0.012 in (0.30 mm) aggregate tolerance to avoid the need for fixturing. (Figures 7-6a and 7-6b.)

Warping of the housing

As with parallelism and flatness of the surface to be gasketed, warping of the entire part can contribute to a Z-axis variation that exceeds the 0.012 in (0.30 mm) tolerance for reproducibility. The trend toward smaller electronic packages with thin housing walls makes this a common occurrence. If surfaces for part hold-down are available, this condition can be accommodated by fixturing. However, setup and production time will be affected.

Figure 7-5 Non-parallelism between receiving surface and pallet surface

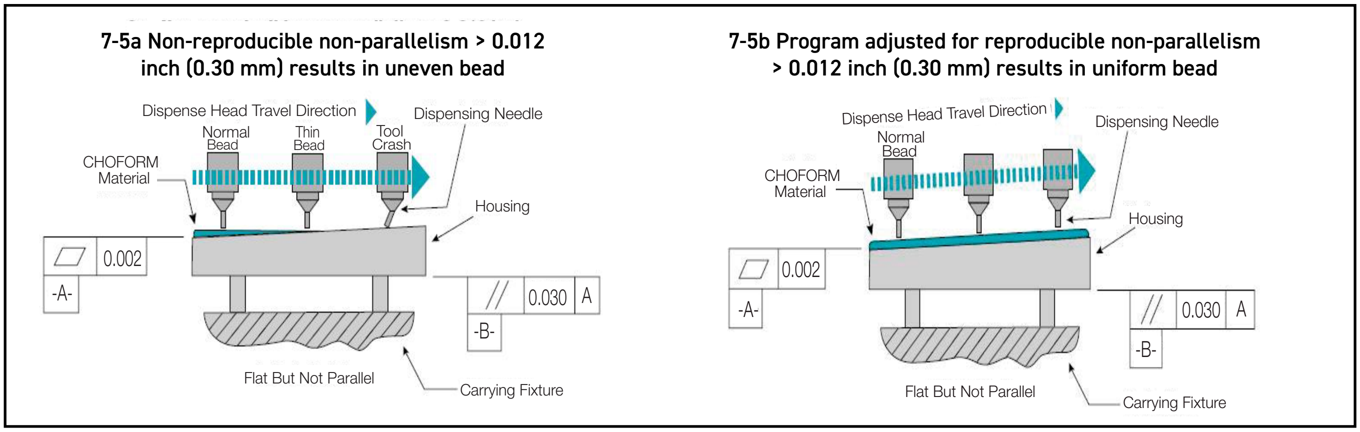
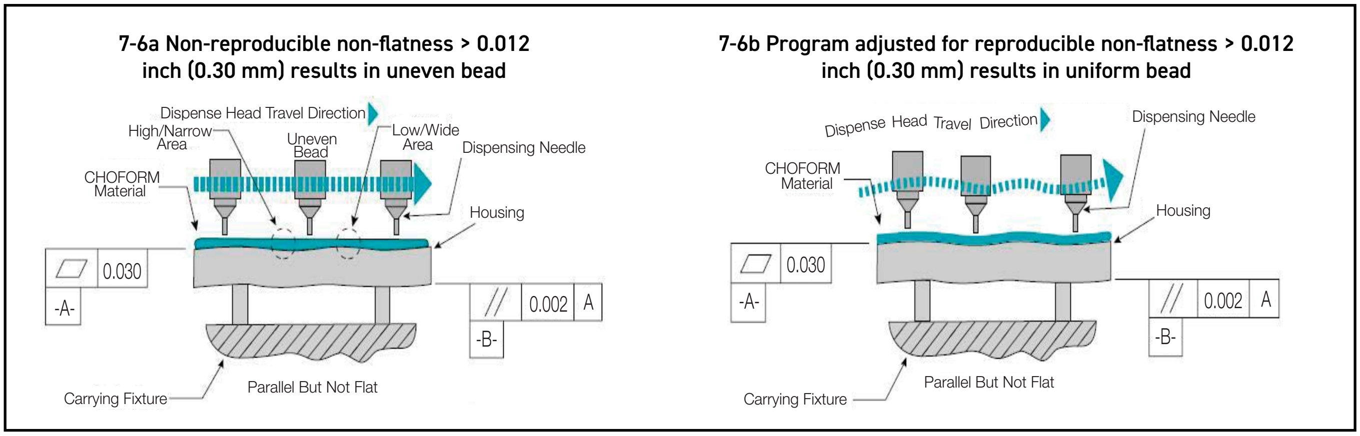


Figure 7-6 Non-flatness of gasketed surface



Keep the need for part restraint to a minimum. When the part-to-part reproducibility of flatness requirement cannot be met, mechanical restraints are fabricated which temporarily flattens the part for proper dispensing of the gasket. Whenever possible, Chomerics exploits design features such as through-holes and edge rails for clamping. If such features do not exist, more complicated fixturing schemes must be designed to induce the necessary flatness, with a corresponding time and cost penalty.

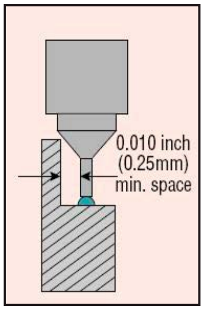


Figure 7-7 Sidewall interference with dispensing needle

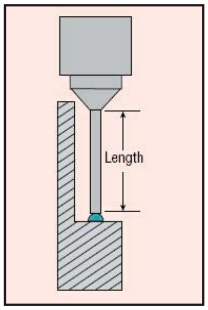


Figure 7-8 High sidewalls may necessitate longer needles, reducing speed

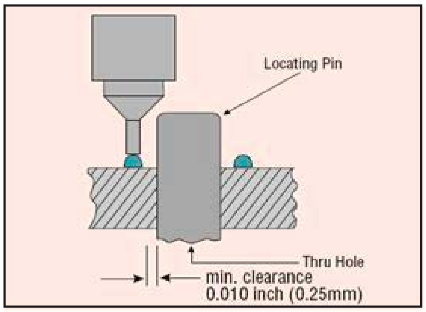


Figure 7-9 Dispensing path obstructed

Avoid Z-axis obstructions. Sidewall proximity to the dispensing needle Often, a form-in-place EMI gasket is applied along a "ledge" adjacent to a higher sidewall. The dimensional tolerances on ledge and sidewall locations are particularly critical, to avoid sidewall interference with the moving needle a minimum of 0.010 in clearance is required (Figure 7-7).

High sidewalls slow dispensing. High sidewalls adjacent to the gasket dispensing path may require an elongated needle to provide the necessary clearance for the dispensing head (Figure 7-8). The longer needle adds friction to material flow, reducing dispensing speed by as much as 75%. This can frequently be avoided by positioning high sidewalls on the mating part or by reducing their height to less than dispensed width of the gasket.

Through-hole interference. In cases where the housing incorporates through-holes used to position the part on its pallet, the holes must not intersect the dispensing path. Clearance of less than 0.010 in (0.25 mm) could result in screw heads or locating pins obstructing the dispensing needle (Figure 7-9).

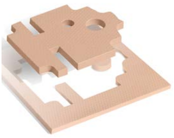
PARKER CHOMERICS CAPABILITIES

THERMAL MANAGEMENT

Thermally Conductive Gels

Highly conformable, high performance fully cured single-component dispensable gap filler ideal for high volume automated dispense processes.

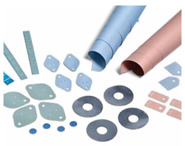
Typical Applications: Telematics, ECU's, EPAS, batteries



Thermal Gap Fillers

Low modulus thermally conductive gap pads offer ease of use, excellent thermal properties and highest conformability for low to moderate clamping force applications.

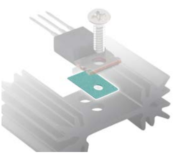
Typical Applications: A/V systems, ACC, braking, battery ECU's



Thermal Insulators

Available in several forms, these materials are designed for use where the highest possible thermal, dielectric and mechanical properties are required.

Typical Applications: Power train, lighting, braking, sensors, ECU's

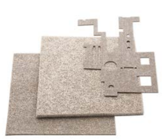


Phase Change Materials

Designed to minimize the thermal resistance between power dissipating electronic components and heat sinks, provide superior long term reliability performance.

Typical Applications: ABS, braking, wipers, transmissions, batteries

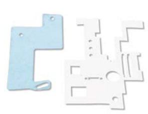
EMI SHIELDING & GROUNDING



Fabric Over Foam Gaskets

SOFT-SHIELD® EMI gasketing products bring new flexibility to shielding decisions. They offer material choices, performance levels, configurations and attachment methods.

Typical Applications: Telematics, ITE, medical, commercial



Laminates and Grounding Products

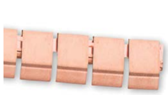
Mechanical, electrical and processing properties plus economy for commercial applications.

Typical Applications: EMI shields, ground planes, ground straps, ESD shields

Wire and Expanded Metal Gasketing

Metal-based gaskets solutions for Electromagnetic Interference (EMI) and Electromagnetic Pulse (EMP) shielding as well as lightning strike protection.

Typical Applications: Connectors, cabinets, military

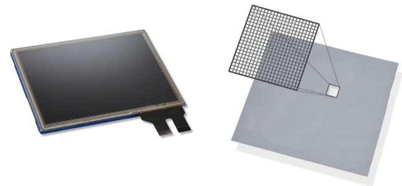


Beryllium Copper and Stainless Steel Gaskets

Beryllium-copper (BeCu) and stainless steel EMI gaskets (SPRING-LINE®) combine high levels of shielding effectiveness with a broad deflection range and low closure force properties.

Typical Applications: Cabinets, enclosures, commercial, military

INTEGRATED DISPLAY SOLUTIONS



CHO-TOUCH Touchscreen LCDs

Parker Chomerics has designed these touchscreen LCDs for harsh environments such as military, medical, avionics, and general industrial.

Typical Applications: Military, medical, aerospace

EMI Shielded Touchscreens and Windows

EMI Shielded touchscreens for rugged performance meeting critical EMC needs. Glass and polycarbonate windows for EMI Shielding and mechanical protection.

Typical Applications: Military, medical, aerospace

CONDUCTIVE PLASTICS

Conductive Plastics

Blend of thermoplastic and conductive fillers that provides world class shielding effectiveness and requires no machining, plating, painting or other added processing steps.

Typical Applications: ACC, sensors, batteries

CONDUCTIVE COMPOUNDS

Specialty Materials

Offering a wide variety of adhesives, caulks, sealants and coatings.

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WARNING: The products described in this catalog can expose you to chemicals including Carbon black extracts, Naphthalene, N-methyl Pyrrolidone, Titanium Dioxide, Ethylene Oxide, Ethyl Benzene, Tetrafluoroethylene, Lead, Nickel Compounds, 1,3-Butadiene, DiChloromethane, Chloroprene,Di(2-ethylhexyl)phthalate(DEHP), Antimony Oxide, which are known to the State of California to cause cancer, and Methyl Chloride, Lead, 1,3 Butadiene, Toluene, EthyleneOxide, Di(2-ethylhexyl)phthalate(DEHP) which are known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

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