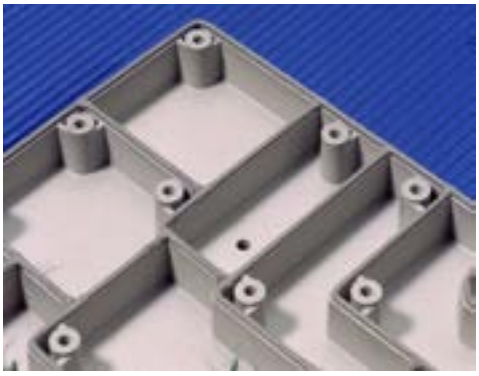
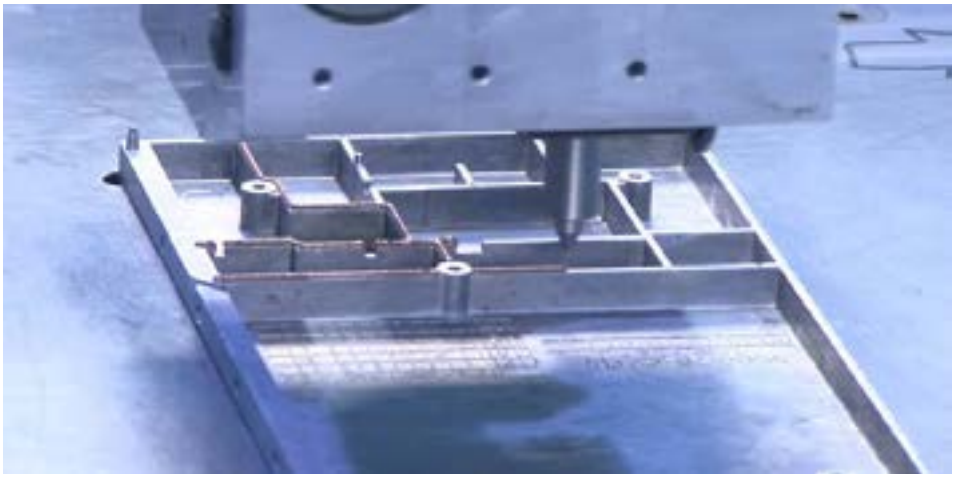
CHOFORM® and ParPHorm® Robotically Dispensed Form-In-Place EMI Gaskets

Customer Value Proposition:

Parker Chomerics CHOFORM Automated EMI Gasketing System is 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 castings, machined metal and conductive plastic housings and board shields. It provides excellent electrical contact to mating conductive surfaces including printed circuit board traces. CHOFORM is widely used in compartmentalized enclosures and other tightly packaged electronic devices in military, telecom, 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. They provide the lowest total cost of ownership for small cross section and complex pattern applications. Parker Chomerics CHOFORM and ParPHorm® Form-In-Place (FIP) materials can reduce installed cost of an EMI gasket by up to 60%. The durable, highly conductive seals have low compression set, ensuring years of effective EMI shielding and mechanical performance.



With gasket dispensing primarily software driven, CHOFORM technology permits rapid prototyping, changes in design, and production scale-up at nominal cost. Its inherent flexibility accommodates batch runs or continuous production, from ten to ten million parts. Wide acceptance of the CHOFORM automated gasket 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 conductive plastic housing or board shield provides an integrated solution ready for the customers' highest level of assembly. Individual compartment shielding or grounding is often enhanced by placement of a secondary EMI product such as a short length of fingerstock, fabric over foam, conductive extrusion gasket or 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, dispensed thermal compound or gel.

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

Product Features:

- Up to 60% space saved -flanges as narrow as 0.025" (0.76mm) can be gasketed.
- 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 typically prototyped and shipped within several days and typically do not require tooling.

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Robotically Dispensed Form-In-Place EMI Gasketing

Excellent Shieiding 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 inch high by 0.040 inch wide (0.86 mm high by 1.0 mm wide).

Denser Packaging is Possible CHOFORM gaskets can be applied to walls or flanges as narrow as 0.025" (0.76 mm), and don't 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 subpaths that form "T" joints wifh 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 for CHOFORM materials appears in Figure 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 platings*
- nickel-copper plating on plastic stainless steel (300 series)
- CHO-SHIELD® 2056, 610, 2040 or 2044 conductive coatings
- Vacuum metallized aluminum

* CrO_x, black chrome, black nickel, bright nickel, tin

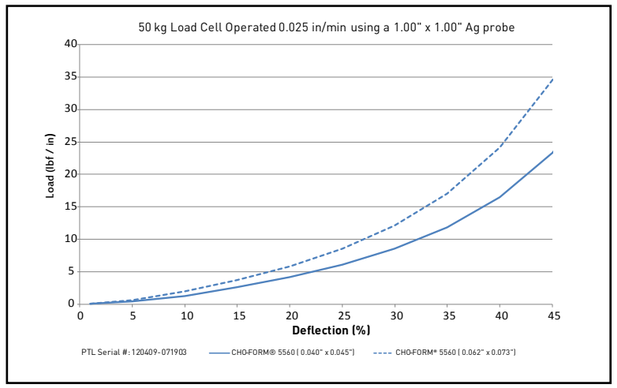
Gasket Application Fully Programmable in 3 Axes Full 3-axis motion of the CHOFORM application technology accommodates uneven surfaces (with a maximum slope of 60° common in castings or injection-molded parts. The result is enhanced control of the gasket cross section.

Tight Dimensional Control and Terminations CHOFORM gasket beads are dispensed with an accuracy of 0.001 inch (0.025 mm), and a cross-sectional height tolerance of 0.006 inch (0.15 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.

Note: Gasket cross section and tolerances will vary slightly at the site of 'start' or 'stop' events in the dispense bead length.

Gasket application to sloped surfaces is fully programmable

Figure 1 Deflection vs Applied Load



Robotically Dispensed Form-In-Place EMI Gasketing

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 C_p and C_{pk} values are approximately1.5.

A Choice of Materials Formulated for Automated Dispensing

CHOFORM materials typically establish 4-12 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. Producing durable, conformable gaskets, all CHOFORM materials can be applied as small as 0.034 inch high and 0.040 inch wide (0.86 mm high and 1.02 mm wide), delivering Cpk values >1.33.
(Exception: CHOFORM 5560 has a minimum applied height of 0.039 inch high and 0.045 inch wide (0.99 mm high and 1.14 mm wide).
Refer to Table 2a "Typical Properties of CHOFORM Materials" for all minimum and maximum bead sizes.

CHOFORM 5575 — One component, moisture cure silicone system, which requires a minimum cure of 18 minutes at 22°C (72°F) at 50% relative humidity. The silver-aluminum filler makes 5575 an 80 dB shielding material, while providing high corrosion resistance against aluminum.

CHOFORM 5513 — Two-component, thermal cure silicone system, which requires a minimum cure of 30 minutes at 140°C (284°F). The Ag/Cu particle filler makes 5513 a > 70 dB shielding material while also having the best adhesion to chromate coated aluminum and most other substrates.

CHOFORM 5541 — One-component, thermal cure silicone system, which requires a minimum cure of 30 minutes at 150°C (302°F). The low cost Ni/Graphite filler makes 5541 a >65 dB shielding material while also providing a good galvanic corrosion resistant gasket when mated with aluminum for outdoor applications. 5541 has very good adhesion properties.

CHOFORM 5550 — One-component, thermal cure silicone system, which requires a minimum cure of 30 minutes at 150°C (302°F). The low cost Ni/Graphite filler makes 5550 a >65 dB shielding material while also providing a good galvanic corrosion resistant gasket when mated with aluminum for outdoor applications. The key property in 5550 is its lower hardness than 5541, however this softer material requires a larger minimum bead size.

CHOFORM 5526 — One-component, room temperature, moisture cure silicone system, which requires a full cure of 24 hours at 50% relative humidity. The pure silver filler makes 5526 our best shielding material at > 100 dB, while providing a soft, low closure force gasket.

CHOFORM 5528 — One-component, room temperature, moisture cure silicone system, which requires a full cure of 24 hours at 50% relative humidity. The Ag/Cu filler makes 5528 a >70 dB shielding material, while providing a soft, low closure force gasket.

CHOFORM 5538 — One-component, room temperature, moisture cure silicone system, which ONLY requires a full cure of 4 hours at 50% relative humidity. The low cost Ni/Graphite filler makes 5538 a >65 dB shielding material while also providing a good galvanic corrosion resistant gasket when mated with aluminum for outdoor applications. 5538 is also capable of the smallest possible bead size.

CHOFORM 5560 — One-component, thermal cure silicone system, which requires a minimum cure of 30 minutes at 150°C (302°F). The Ni/Al filler makes 5560 a very good >90 dB shielding material while also providing the best galvanic corrosion resistant gasket when mated with aluminum for even the harshest salt spray / salt fog environments.

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ParPHorm Form-In-Place Sealing Compounds

ParPHorm is a family of non-conductive, thermal and moisture cure, form-in-place, elastomeric sealing compounds. These silicone and fluorosilicone materials provide environmental, fluid, and dust sealing of small enclosures. The product line consists of state-of-the art compounds designed to be robotically dispensed onto small housings and then cured. Curing of the 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 2b.

DESCRIPTION - Thermal Cure Materials
ParPHorm S1945 (Discontinued)

ParPHorm S1945 is a silicone FIP material with lower hardness (Shore A 25) and excellent compression set (21%). ParPHorm S1945 is especially designed for low closure force applications and those requiring exceptional adhesion properties. Due to its minimal hardness, S1945, is one of the most widely used ParPHorm materials and thus has extensive application in many areas. The compound adheres well to aluminum, phenolic resins, copper, stainless steel, glass, rigid PVC, most ceramics, and various plastics. ParPHorm S1945 is compatible with air below 400° F, ethylene glycol, nitrogen, sea (salt) water, magnesium sulfite and sulfate, citric acid, methanol, ozone, soap solutions, zinc salts and zinc sulfates, potassium chloride/ nitrate, barium chloride/hydroxide/salts, sodium chloride/ salts/sulfates, and glycols.

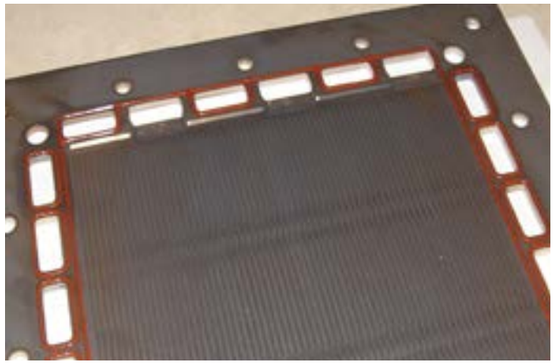
ParPHorm L1938

ParPHorm L1938 is a fluorosilicone FIP elastomer with Shore A hardness of 45 and compression set rating of 14%. This fluorosilicone material offers additional fluid resistance capabilities above and beyond the capabilities of S1945.

FEATURES
- One component thermal cure materials
- 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 MATERIAL

ParPHorm S1945, and L1938 are one component, thermal cure materials. 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.



DESCRIPTION - Moisture Cure Materials
ParPHorm 1800

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 48 hours. Minimum bead size is 0.018" (0.46 mm) tall by 0.022" (0.56 mm) wide. Maximum bead size is .062" (1.57 mm) tall by 0.075" ((1.91 mm) wide. Application advantages of the material are excellent adhesion, low hardness, and 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. Parker Chomerics offers worldwide capabilities for dispensing of this material onto customer supplied housings. Parker Chomerics can also provide supply chain management of the process and source the housings along with ParPHorm dispensing and finishing operations such as painting and minor mechanical assembly.

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 MATERIAL

ParPHorm 1800 is a one component, moisture cure material. 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 4 hours.

CHOFORM and ParPHorm Form-In-Place Sealing Compounds

DESIGN AND PROTOTYPING

Application and design assistance is available to prospective customers. The specific focus of the assistance is on the examination/identification of design issues with regard to 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 are easily dispensed from a variety of commercially available gasket dispense systems. In addition to Parker Chomerics existing worldwide network of CHOFORM applicators, our CHOFORM applications engineering group can provide support for material dispense needs worldwide for customers wishing to utilize their own or other dispense equipment.

Table 1a - CHOFORM Ordering Information

Material	Part Number	Material Weight	Packaging Type Size
5575	19-26-5575-0240 19-26-5575-0500	240 grams 500 grams	6oz SEMCO Tube 12 fl. oz. Aluminum Cartridge
5513	19-26-5513-0850	Part A 450 grams Part B 475 grams	12 fl. oz. SEMCO Tube 12 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

Table 1b - 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
S1945 (Discontinued)	19-26-1945-0250	250 grams	12 fl. oz. SEMCO Tube

Form-In-Place Selector Guide

Table 2

CHOFORM - Conductive Form-In-Place Gaskets						
Typical Properties	**Test Procedure**	**Units**	**CHOFORM® 5513**	**CHOFORM® 5541**	**CHOFORM® 5550**	**CHOFORM® 5560**
Features	--	--	Excellent electrical properties and adhesion	Corrosion resistant, high temp	Soft Ni/C, corrosion resistant	Excellent corrosion resistance on Aluminum
Conductive Filler	--	--	Ag/Cu	Ni/C	Ni/C	Ni/Al
Resin 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	--	--	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	30 mins @ 150°C 30 mins @ 150°C 30 mins @ 150°C
Hardness	ASTM D 2240	Shore A	53	75	55	55
Tensile Strength	ASTM D 412	psi	350	500	175	165
Elongation	ASTM D 412	%	255	125	175	150
Specific Gravity	ASTM D 395	--	3.4	2.4	2.2	1.8
Volume Resistivity	Chomerics MAT-1002	Ω-cm	0.004	0.030	0.035	0.13
Galvanic Corrosion Resistance Against Alum	Chomerics TM-100	Weight Loss mg	NR	32	20	4
*Compression Set 22 hrs @ 70°C	ASTM D 395 Method B	%	28	30	25	25
Maximum Use Temp	--	°C (°F)	125 (257)	125 (257)	125 (257)	125 (257)
Flammability Rating	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	18	12	6
Force Deflection @ 30% Compression 0.034" x 0.040" sized bead (0.86 mm x 1.02 mm) English Metric	ASTM D 375 Mod ASTM D 375 Mod	lb-f/in N/cm	60 105.1	81.0 141.8	32.4 56.7	12.5 21.9
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	Store in freezer @ -10 +/- 2			

*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 using Chomerics standard pneumatic equiptment and off the shelf dispensing needles.

Note: NR - Not Recommended, NA - Not Applicable See Chomerics for product specifications if needed

The user, through their 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.

(Force per cm x total bead length in centimetres gives you the total force)

Cure System Legend

Moisture Cure	Thermal Cure

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Form-In-Place Selector Guide

Table 2 continued

CHOFORM - Conductive Form-In-Place Gaskets						
Typical Properties	**Test Procedure**	**Units**	**CHOFORM® 5575**	**CHOFORM® 5526**	**CHOFORM® 5528**	**CHOFORM® 5538**
Features	--	--	High corrosion resistance on aluminum	High conductivity, excellent grounding and shielding	Soft, low closure-force	Corrosion resistant, small bead
Conductive Filler	--	--	Ag/Al	Ag	Ag/Cu	Ni/C
Resin 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 D 2240	Shore A	80	38	40	65
Tensile Strength	ASTM D 412	psi	180	80	125	325
Elongation	ASTM D 412	%	50%	75	100	65
Specific Gravity	ASTM D 395	--	1.9	3.6	3.4	2.2
Volume Resistivity	Chomerics MAT-1002	Ω-cm	0.010	0.003	0.005	0.050
Galvanic Corrosion Resistance Against Alum	Chomerics TM-100	Weight Loss mg	Not Tested	NR	NR	10
*Compression Set 22 hrs @ 70°C	ASTM D 395 Method B	%	40%	45	45	45
Maximum Use Temp	--	°C (°F)	125 (257)	85 (185)	85 (185)	85 (185)
Flammability Rating	UL 94	--	V-0	V-0	V-0	V-0
Shielding Effectiveness (avg 200 MHz - 12 GHz)	Modified IEEE-299	dB	80	>100	>70	>60
Adhesion Trivalent Chromate Coating on Alum	Chomerics WI 038	N/cm	10	9	3.8	9
Force Deflection @ 30% Compression 0.034" x 0.040" sized bead (0.86 mm x 1.02 mm) English Metric	ASTM D 375 Mod ASTM D 375 Mod	lb-f/in N/cm	10	15.0 26.3	20 35.0	28.5 49.8
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	Room temp. 22 +/- 5	Room temp. 22 +/-5	Room temp. 21 +/- 5	Room temp. 22 +/- 5

*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 using Chomerics standard pneumatic equiptment and off the shelf dispensing needles.
Note: NR - Not Recommended, NA - Not Applicable See Chomerics for product specifications if needed.

Table 3

ParPHorm - Non-Conductive Form-In-Place Gaskets					
Typical Properties	**Test Procedure**	**Units**	**ParPHorm® 1800**	**ParPHorm® S1945-25 (DISCONTINUED)**	**ParPHorm® L1938-45**
Hardness	ASTM D2240	Shore A	20	25	45
Tensile Strength	ASTM DD412	(min.) (psi)	150	277	616
Elongation	ASTM D412	%	650	316	271
Specific Gravity	ASTM D297	--	1.4	0.78	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 -- -- --	42 21 -- --	29 14 29 --
Cure System	--	--	Moisture	Thermal	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	30 mins @ 140° C 30 mins @ 140° C 30 mins @ 140° C
Resin System	--	--	Silicone	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)	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	6
Storage Conditions	Chomerics	°C	Room temp. 21 +/- 5	Room temp. 21 +/- 5	Store in freezer @ -10 +/- 5

Optimizing the Design of CHOFORM Shielded Housing Assemblies

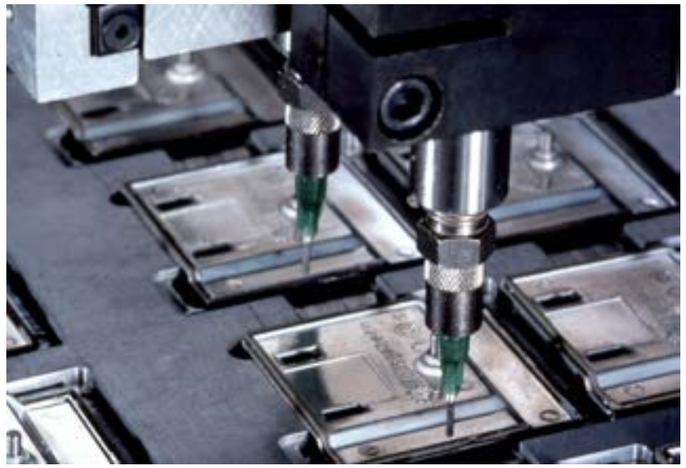
Important Considerations for Optimizing Quality & Production Efficiency
A shielded housing is an assembly whose quality and performance are functions of all the parts and processes used to produce it.

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 necessitates 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.

Optimizing the Design of CHOFORM Shielded Housing Assemblies

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 2-5 illustrate the nature of these intrinsic differences and the adjusted tolerances in the initiation and termination zones, which are defined as 0.100 inch (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 3 and 4.

In programming the dispense path, sufficient 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.

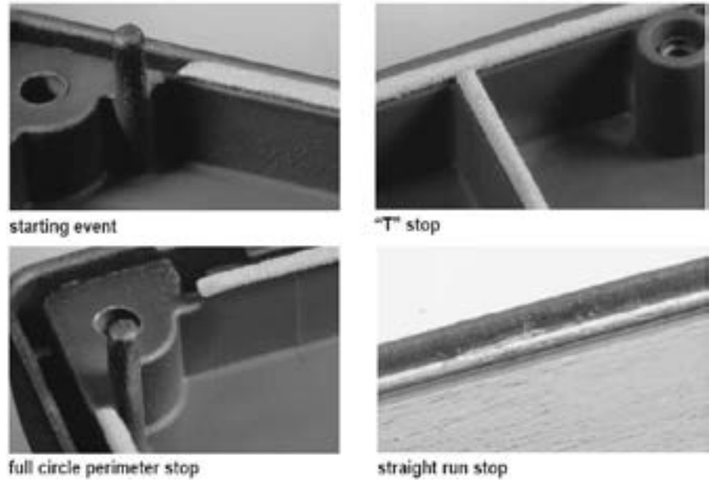


Figure 2 Characteristic appearance of start/stop events

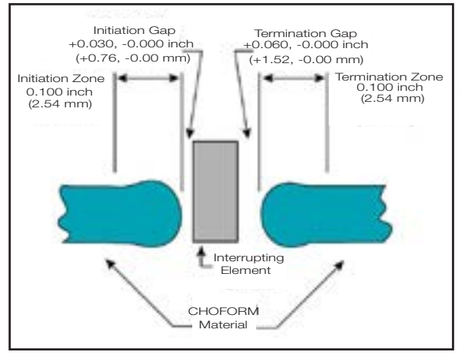


Figure 3 - Top View Location tolerances for bead initiation & termination zones (cross-sectional view)

Figure 4 - Side View Gasket height tolerances

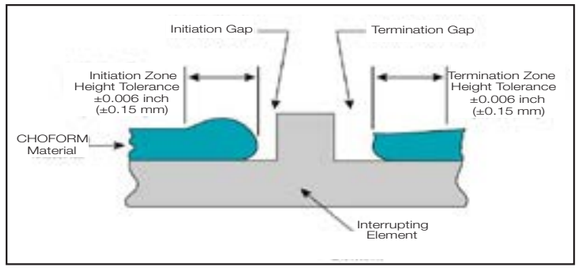
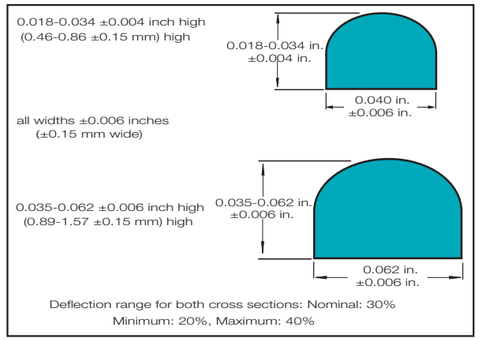


Figure 5 Suggested cross sections with height-to-width ratio of 0.85



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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:

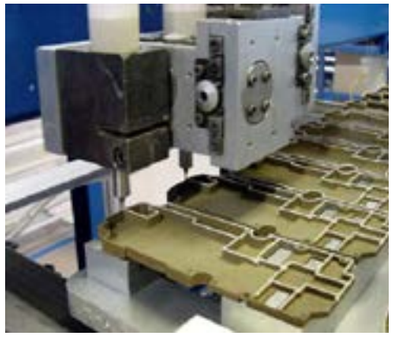
Positive Locating Features Speed Production

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 inch (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 inch (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 inch (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 3 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

As a whole, these elevation deviations must be consistent from part to part within 0.012 inch (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.

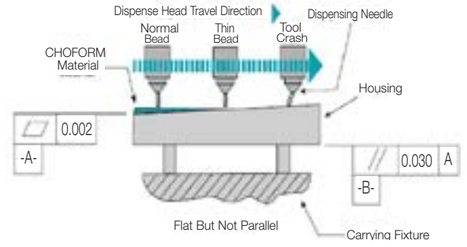
Parallelism to a defined plane
Using one or more specific part features for locating purposes, housings are mounted on a machined pallet and conveyed to the dispensing head. The pallet surface defines the "datum plane" for Z-axis motion of the dispensing needle.
CHOFORM gaskets can be dispensed onto a part surface of known slope with respect to the datum plane (reccomended up to 60°). Application onto a flat surface (i.e., 0° slope) can actually 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 inch (0.30 mm) aggregate allowable tolerance to avoid the need for special fixturing. (Figures 6 a-b.)

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 inch (0.30 mm) aggregate tolerance to avoid the need for fixturing. (Figures 7a-b.)

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 inch (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.

Optimizing the design of CHOFORM Shielded Housing Assemblies

6a Non-reproducible non-parallelism >0/012 inch (0.30 mm) results in uneven bead



6b Program adjusted for reproducible non-parallelism >0/012 inch (0.30 mm) results in uniform bead

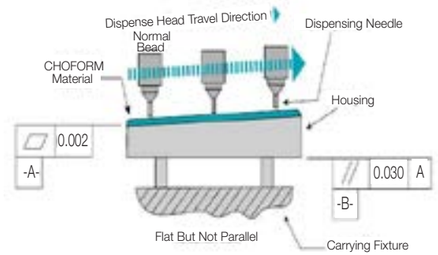
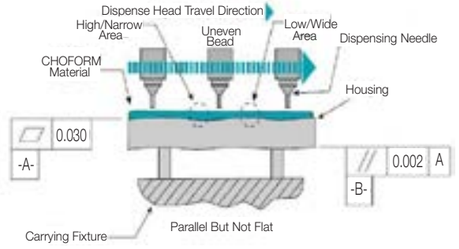


Figure 6 Non-parallelism between receiving surface and pallet surface

7a Non-reproducible non-flatness >0/012 inch (0.30 mm) results in uneven bead



7b Program adjusted for reproducible non-flatness >0/012 inch (0.30 mm) results in uniform bead

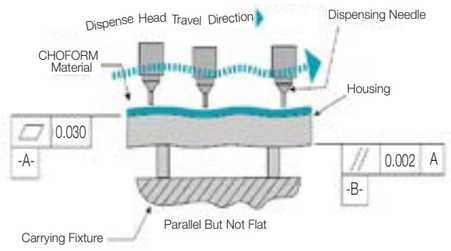


Figure 7 Non-flatness of gasketed surface

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.

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" clearence is required (Figure 8).

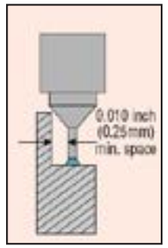


Figure 8 Sidewall interference with dispensing needle

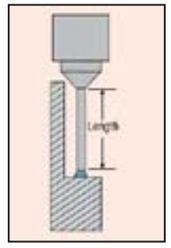


Figure 9 High sidewalls may necessitate longer needles, reducing speed

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 9). 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

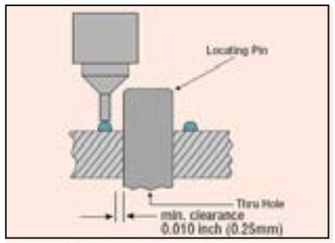


Figure 10 Dispensing path obstructed

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 inch (0.25 mm) could result in screw heads or locating pins obstructing the dispensing needle (Figure 10).

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