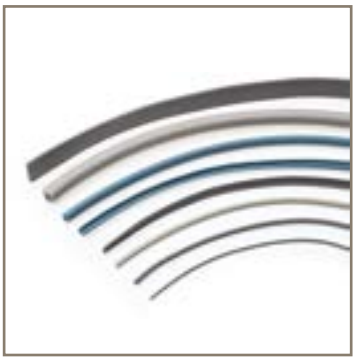
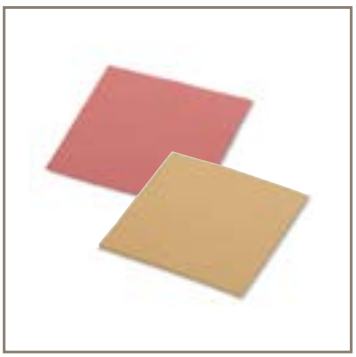




Powering the Future of EV/Hybrid Vehicles

Thermal Interface Materials,
EMI Shielding and Electronic Component Housings

Parker Chomerics

ENGINEERING YOUR SUCCESS.

Solution Provider to the Electric and Hybrid Vehicle OEM Marketplace

With the growing demand for battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV), dissipating battery heat and providing protection against electrical interference have never been more pertinent. The Parker Chomerics family of thermal interface materials, coupled with our premier electromagnetic interference (EMI) shielding products, offers solutions for global OEMs and tier one suppliers of automotive modules.

1

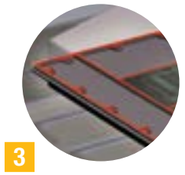
Power Cables Connector

CHO-SEAL® EMI elastomer gaskets for EMI shielding of power cable connectors.

2

Power Inverter/Converter Cover

PREMIER™ electrically conductive plastics used for metal-to-plastic conversion. Eliminates up to 35% of weight of traditional die cast aluminum housings.



3

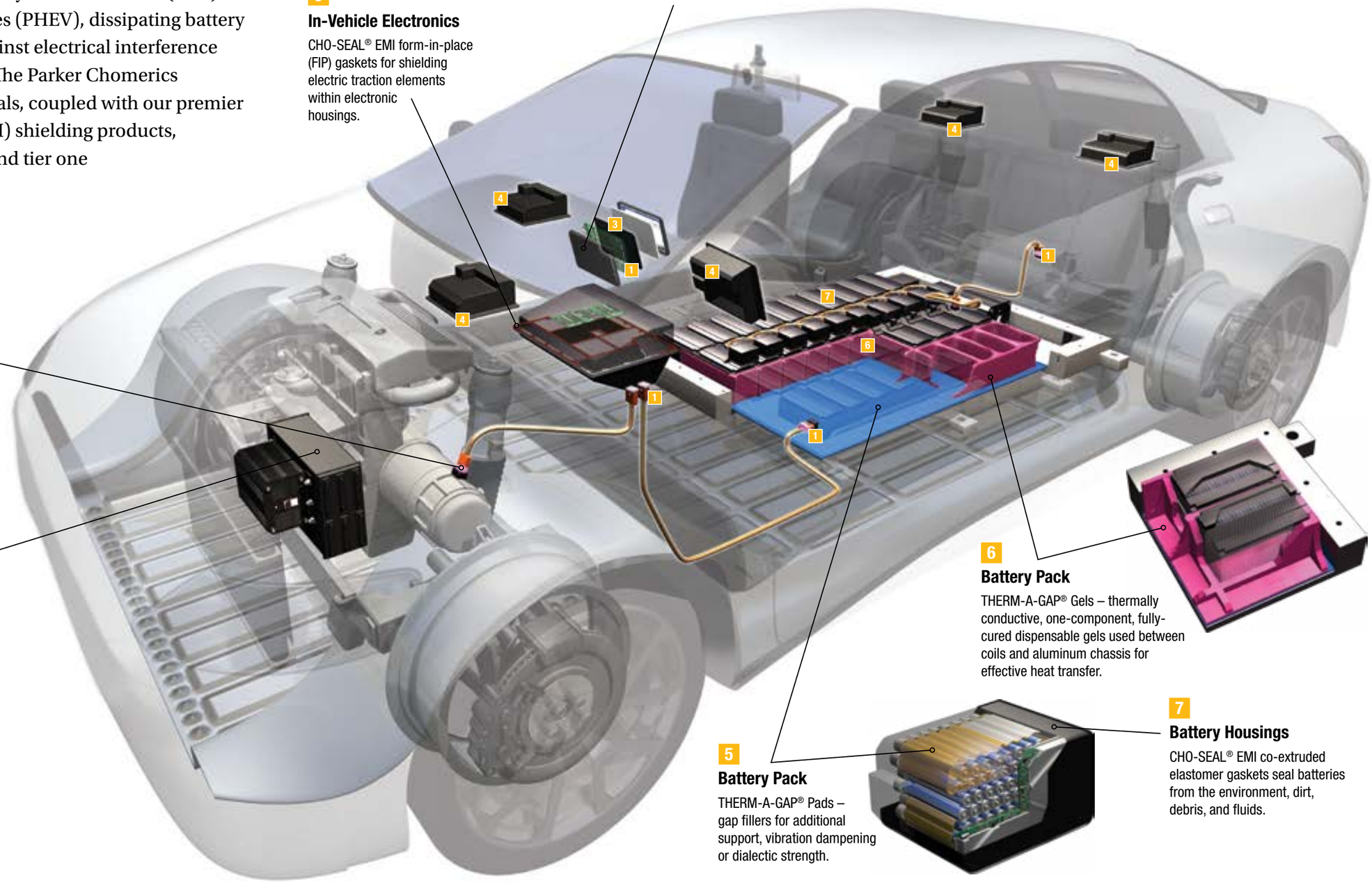
In-Vehicle Electronics

CHO-SEAL® EMI form-in-place (FIP) gaskets for shielding electric traction elements within electronic housings.

4

Infotainment/Advanced Driver Assistance Systems

PREMIER™ electrically conductive plastics used for metal-to-plastic conversion. Eliminates up to 35% of weight of traditional die cast aluminum housings.



6

Battery Pack

THERM-A-GAP® Gels – thermally conductive, one-component, fully-cured dispensable gels used between coils and aluminum chassis for effective heat transfer.

5

Battery Pack

THERM-A-GAP® Pads – gap fillers for additional support, vibration dampening or dialectic strength.

7

Battery Housings

CHO-SEAL® EMI co-extruded elastomer gaskets seal batteries from the environment, dirt, debris, and fluids.

An OEM System Solution from Parker Chomerics

Although electric vehicles represent a greener and cleaner future, they come with a number of technology challenges for manufacturers and systems suppliers. Issues include dissipating heat generated by the battery pack, eliminating electromagnetic interference and reducing vehicle weight.

Battery Heat Management

Left unchecked, excessive heat causes faster battery wear, reduced performance (due to uneven temperature distribution) and reduced charge efficiency, not to mention the safety hazards associated with thermal runaway. Effective thermal management is therefore critical to optimizing battery performance and longevity, along with improved safety and reliability, allowing vehicles to travel greater distances and increasing the achievable run-time on a single charge.

The technique for delivering thermal management is often liquid cooling, whereby two cooling loops/coils typically serve various sub-assemblies of the battery to manage heat. While batteries and cooling fluid clearly do not mix, there are safety concerns with liquid cooling due to corrosion and leaks, which could lead to an electrical short. Therefore, thermal interface materials are dispensed between the coils and the aluminum chassis of the battery for greater safety. This delivers long-term thermal stability and performance, and also reduces the risk of an electrical short.

Thermally conductive, dispensable gel products are proven in the function of battery heat management. Offerings include one-component, pre-cured gels featuring a cross-linked structure, as well as two-component cure-in-place (CIP) gels which can also act as a potting compound and flow around complex parts. Both silicone and non-silicone gels are available depending on specific thermal conductivity requirements.

Chomerics Division is part of the Parker Hannifin Corporation Engineered Materials Group and is a global leader in development and application of electrically and thermally conductive materials in electronics, transportation and alternative energy systems. Chomerics is the first choice in EMI shielding and thermal management solutions for automotive, information technology, medical devices, military, commercial and consumer electronics industries.

For over 50 years, Chomerics' strong portfolio has delivered cutting edge solutions to our global customers using technology built on core competencies in material science and process technology.

These compounds are particularly suitable in high volume markets such as automotive due to ease-of-dispensing using robotics or automation, thus considerably reducing cycle times and costs. They also enhance safety, by providing stability at temperatures up to 392˚F (200˚C).

Thermally conductive filler pads are also available depending on the design of the battery packs. These products are ideal for assemblies that might require some additional support such as vibration dampening.

As a benefit for drivers during cold winter months, thermal interface gels and pads help the battery reach its optimum temperature and performance much quicker than without having these materials in place.

Electromagnetic Interference (EMI) Shielding

Beyond effective thermal management, another technology challenge is the need to shield against EMI. The cables that travel between the battery and engine, as well as the battery and charger, see high current produced at low frequency. This produces a large magnetic field that can negatively affect other electronics within the vehicle. High shielding attenuation is also required to protect the battery and its circuits from any incoming EMI.

To overcome these issues, a variety of EMI shielding elastomers or extruded gaskets can be used. EMI gaskets are filled with conductive particles and connect interfacing components to reduce the air gap and create a Faraday Cage that blocks EMI fields. Among many attributes, they resist compression set and accommodate low closure force.

Very often batteries also need to be sealed against environmental dirt, debris and fluids. Here, it is possible to deploy combined solutions to support EMI and environmental shielding/sealing.

For battery applications requiring co-extruded gaskets, such as shielding the electric traction elements, special form-in-place (FIP) materials are available. Again, these lend themselves to robot dispensing, while the ability to create bespoke shapes is a further benefit.

Metal-to-Plastic Conversion

Replacement of metal housings with plastic versions can contribute to reducing vehicle weight and cutting manufacturing costs. Here, an electrically conductive plastic alternative can be exchanged for the battery electronic control unit's (ECU) conventional die-cast aluminum housing. Metal to plastic conversions not only eliminate 35% of the housing weight, but also provide cost reductions of up to 65% by eliminating secondary operations such as assembly and machining.

Featured Parker Chomerics Products

Battery Thermal Management and Cooling: Thermally Conductive Dispensible Gels

THERM-A-GAP™ thermally conductive dispensible gels are pre-cured, single-component compounds that can be robotically dispensed on the heat-generating component.

Product	Features	Thermal Conductivity (W-m/K)	Product Type	Flow Rate (cc/min)
THERM-A-GAP™ GEL T630	General use, lowest deflection force required, UL 94 V-0	0.7	One Part	10
THERM-A-GAP™ GEL T635	General use with very good thermal performance	1.7	One Part	8
THERM-A-GAP™ GEL T636	General use with excellent thermal performance, UL 94 V-0	2.4	One Part	8
THERM-A-GAP™ GEL 8010	Ideal for thin bondlines, UL 94 V-0	3.0	One Part	60
THERM-A-GAP™ GEL 30	Easily dispensible, high performance, UL 94 V-0	3.5	One Part	20
THERM-A-GAP™ GEL 45	Easily dispensible, high end performance	4.5	One Part	55
THERM-A-GAP™ TC50	Controlled dispensing, high end thermal performance	5.5	One Part	10

Battery Thermal Management and Cooling: Thermally Conductive Gap Filler Pads

THERM-A-GAP™ thermally conductive silicone and non-silicone gap filler pads for applications where heat must be conducted over a large and variant gap.

Product	Features	Thermal Conductivity (W-m/K)	Hardness (Shore 00)	Flammability Rating
THERM-A-GAP™ HCS10	Economical solution, highest conformability	1.0	4	UL 94 V-0
THERM-A-GAP™ 569	Great combination of thermal performance and conformability	1.5	10	UL 94 V-0
THERM-A-GAP™ 570	Best for molding complex parts and vibration dampening	1.5	25	UL 94 V-0
THERM-A-GAP™ 579	Lowest outgassing, excellent thermal performance	3.0	30	UL 94 V-0
THERM-A-GAP™ 580	Lowest outgassing, best for molding complex parts	3.0	75	UL 94 V-0
THERM-A-GAP™ 974	Excellent thermal performance, PSA available	6.0	86	N/A
THERM-A-GAP™ G974	Fiberglass reinforced for improved tear strength	5.0	86	UL 94 V-0

Battery Thermal Management and Cooling: Cure-in-Place Potting and Underfill Materials

THERM-A-FORM™ thermally conductive elastomer products are dispensable form-in-place compounds designed for heat transfer without excessive compressive force.

Product	Features	Thermal Conductivity (W-m/K)	Product Type	Hardness (Shore A)
THERM-A-FORM™ T647	Superior thermal performance while maintaining low modulus	0.9	Two Part	25
THERM-A-FORM™ T646	Provides combination of high thermal performance and low cost	1.0	Two Part	50
THERM-A-FORM™ T644	Very low modulus material for transferring heat from fragile components	1.0	Two Part	15
THERM-A-FORM™ T642	High thermal performance, ideal for underfilling, low outgassing	1.0	Two Part	70
THERM-A-FORM™ 1642	General duty material, economical thermal solution	1.0	Two Part	76

Featured Parker Chomerics Products

Electromagnetic Interference Mitigation: Elastomer EMI Shielding Gaskets

Gaskets for shielding of battery packs and battery management systems (BMS) as well as on board chargers.

Product	Conductive Filler	Binder	Shielding	Corrosion
CHO-SEAL® 6502	Nickel-Aluminum	Silicone	Excellent	Excellent
CHO-SEAL® 6503	Nickel-Aluminum	Fluorosilicone	Excellent	Excellent
CHO-SEAL® 1298	Silver-Aluminum	Fluorosilicone	Good	Very Good
CHO-SEAL® 1285	Silver-Aluminum	Silicone	Very Good	Good
CHO-SEAL® 1287	Silver-Aluminum	Fluorosilicone	Good	Good
CHO-SEAL®1215	Silver-Copper	Silicone	Excellent	Fair
CHO-SEAL® 1217	Silver-Copper	Fluorosilicone	Excellent	Fair

More products available, see Conductive Elastomer Engineering Handbook for complete list.

Electromagnetic Interference Mitigation: Form-in-Place EMI Shielding Gaskets

CHO-FORM™ form-in-place elastomer products are dispensable form-in-place compounds designed for heat transfer without excessive compressive force.

Product	Conductive Filler	Resin System	Number of Components	Cure System
CHOFORM® 5513	Silver-Copper	Silicone	Two Part	Thermal
CHOFORM® 5541	Nickel-Carbon	Silicone	One Part	Thermal
CHOFORM® 5550	Nickel-Carbon	Silicone	One Part	Thermal
CHOFORM® 5560	Nickel-Aluminum	Silicone	One Part	Thermal
CHOFORM® 5526	Silver	Silicone	One Part	Moisture
CHOFORM® 5528	Silver-Copper	Silicone	One Part	Moisture
CHOFORM® 5538	Nickel-Carbon	Silicone	One Part	Moisture

Conductive Plastics: PREMIER™ EMI Shielding Plastics

Conductive plastics eliminate 35% of the housing weight (as compared to aluminum) and reduce coss by 65% white providing excellent hydrolysis resistance.

Product	Filler Level	Flammability Rating	Surface Resistance (Ohm/sq)	Shielding Effectiveness (dB)
PREMIER™ A220-HT	Low	N/A	4.50	60
PREMIER™ A240-ST	High	N/A	0.20	85
PREMIER™ A240-FRHF	High	UL 94 V0	0.25	85
PREMIER™ PEI 140	High	UL 94 V0	0.45	85
PREMIER™ PBT-225	Medium	UL 94 HB	10.0	80

Chomerics Worldwide

Corporate Facilities

To place an order please contact a customer service representative at the following locations

North America

Global Division Headquarters
77 Dragon Court
Woburn, MA 01888
Phone +1 781-935-4850
Fax +1 781-933-4318
chomailbox@parker.com

Europe

Parker Hannifin Ltd
Chomerics Division Europe
Unit 6, Century Point
Halifax Road
High Wycombe
Bucks HP12 3SL
UK
Phone +44 1494 455400
Fax +44 14944 55466
chomerics_europe@parker.com

Parker Hannifin Mfg France SAS
Chomerics Division Europe
ZI du Vert Galant
6/8 av du Vert Galant
95310 St Ouen l'Aumône
France
Phone +33 1343 23900
Fax +33 1343 25800

Asia Pacific

Parker Hannifin
Chomerics Shanghai
280 Yunqiao Road
Jin Qiao Export Processing Zone
Shanghai 201206, China
Phone +86 21 2899 5000
Fax +86 21 2899 5146
chomerics_ap@parker.com

Parker Hannifin
Chomerics Shenzhen
No. 5 Bldg Jinrongda Technological
Park, Gangtou Village
Bantian Longgang District
Shenzhen, 518122, China
Phone +86 755 8974 8558
Fax +86 755 8974 8560
chomerics_ap@parker.com

Parker Hannifin
Chomerics Kuala Lumpur
Lot 15, Jalan Gudang 16/9
Section 16
Shah Alam Industrial Estate
40200 Shah Alam
Selangor, Malaysia
Phone +603 5510 9188
Fax +603 5512 6988
chomerics_ap@parker.com

Penang, Malaysia
No. 3, Puncak Perusahaan 1
13600 Prai
Penang, Malaysia
Phone +604 398329
Fax +604 3983299
chomerics_ap@parker.com

Parker Hannifin India Pvt Ltd
Chomerics Division
Plot No. 41/2, 8th Avenue DTA
Anjur Village, Mahindra World City
Chengalpattu
Tamil Nadu - 603 004, India
Phone +91 44 67132333
Phone +91 44 67132045
chomerics_ap@parker.com

Manufacturing Facilities

Woburn, MA; Hudson, NH; Cranford, NJ; Millville, NJ; Fairport, NY; Monterrey, Mexico; Grantham, UK; High Wycombe, UK; Saint Ouen L'Aumone, France; Sadska, Czech Republic; Shanghai, PRC; Shenzhen, PRC; Penang, Malaysia; Kuala Lumpur, Malaysia; Chennai, India.

www.parker.com/chomerics

Literature Number: TB 1500 EN

Parker Chomerics

ENGINEERING YOUR SUCCESS.