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HENKEL SOLUTIONS FOR E-MOBILITY

BATTERY SYSTEMS, POWER CONVERSION SYSTEMS AND E-DRIVE SYSTEMS



Henkel

Content

Customer Challenges and Henkel Solutions Offering	03
Henkel Solutions for EV Battery Systems	05
Customer Use Case BERGQUIST® TGF 2010 APS	10
Henkel Solutions for Power Conversion Systems	12
Customer Use Case BERGQUIST® GAP FILLER TGF 3600, BERGQUIST® GAP PAD® TGP 1000VOUS, LOCTITE® SI 5970	16
Henkel Solutions for E-Drive Systems	17
Customer Use Case LOCTITE® PE 1000LV	21
Battery Engineering Center	22
Our Global Presence	26

eMOBILITY
ENABLED BY HENKEL



OUR AIM IS TO THOROUGHLY UNDERSTAND our customers' challenges and needs...

1. BATTERY SYSTEMS

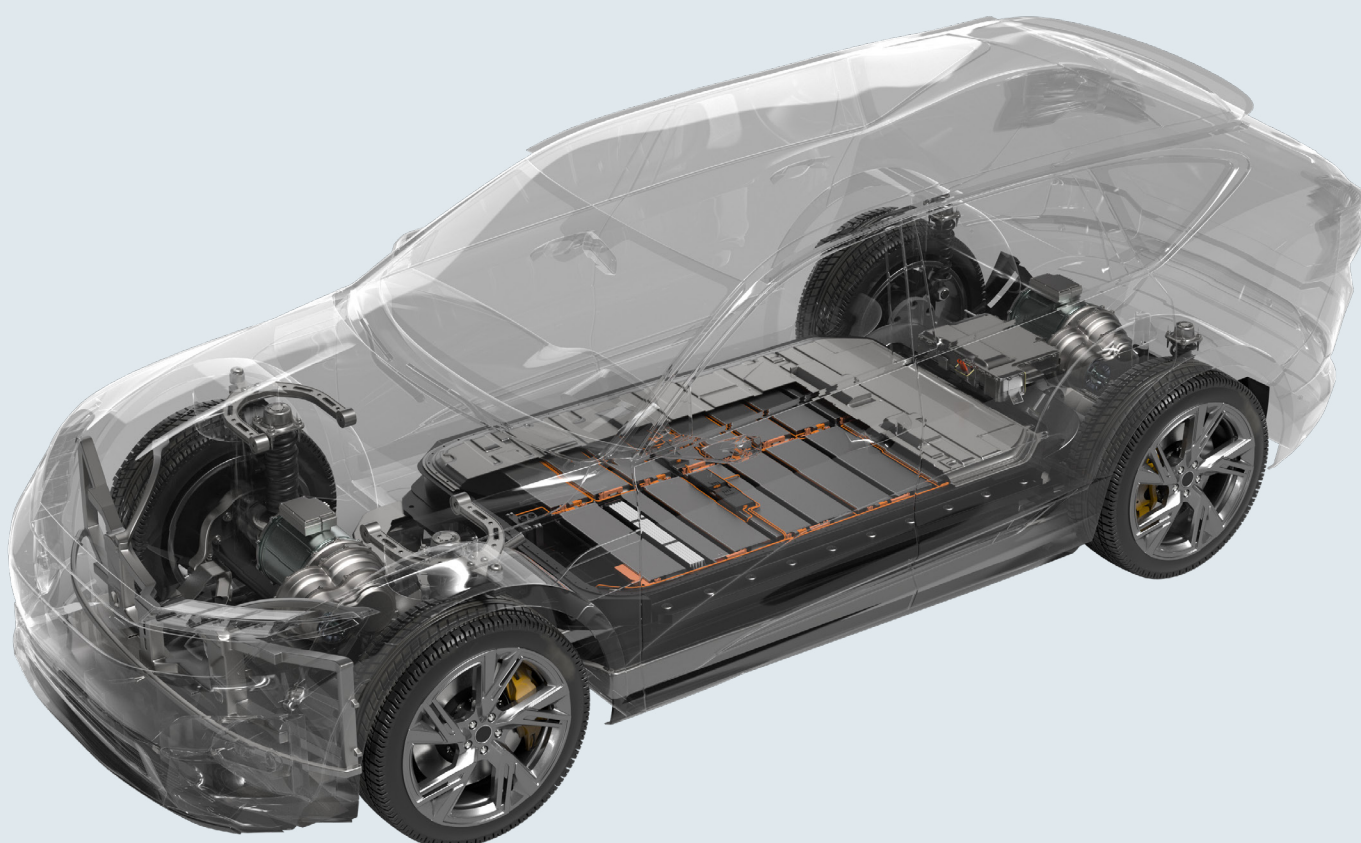
Battery systems are the most critical component of an electric vehicle, accounting for approximately 20% of the car by weight and 50% by cost. Cost efficiency, passenger safety, vehicle reliability and lightweighting are all important considerations for battery design, making efficient and secure component assembly as well as thermal management a priority.

2. POWER CONVERSION SYSTEMS

Power conversion systems are complex components that have to handle very high voltages as well as both DC and AC, while subjected to harsh electrical and environmental factors. Efficient sealing, electrical insulation and thermal management are essential for optimal performance of these components.

3. E-DRIVE SYSTEMS

Electric motors are subjected to the harshest vibrations and environmental conditions. It is one of the key systems in the EV architecture that has moving components, making structural integrity, sealing and thermal management key for reliable and optimal performance.



... AND TO RESPOND ACCORDINGLY

with a full solution package.

We are committed to solving the engineering and commercial challenges through a combination of:

1. BROAD TECHNOLOGY PORTFOLIO

We have a market leading position in thermal interface materials, adhesives, sealants and functional coatings. In addition, we support our customers overcome engineering challenges by leveraging our strong R&D competences to develop customized solutions.

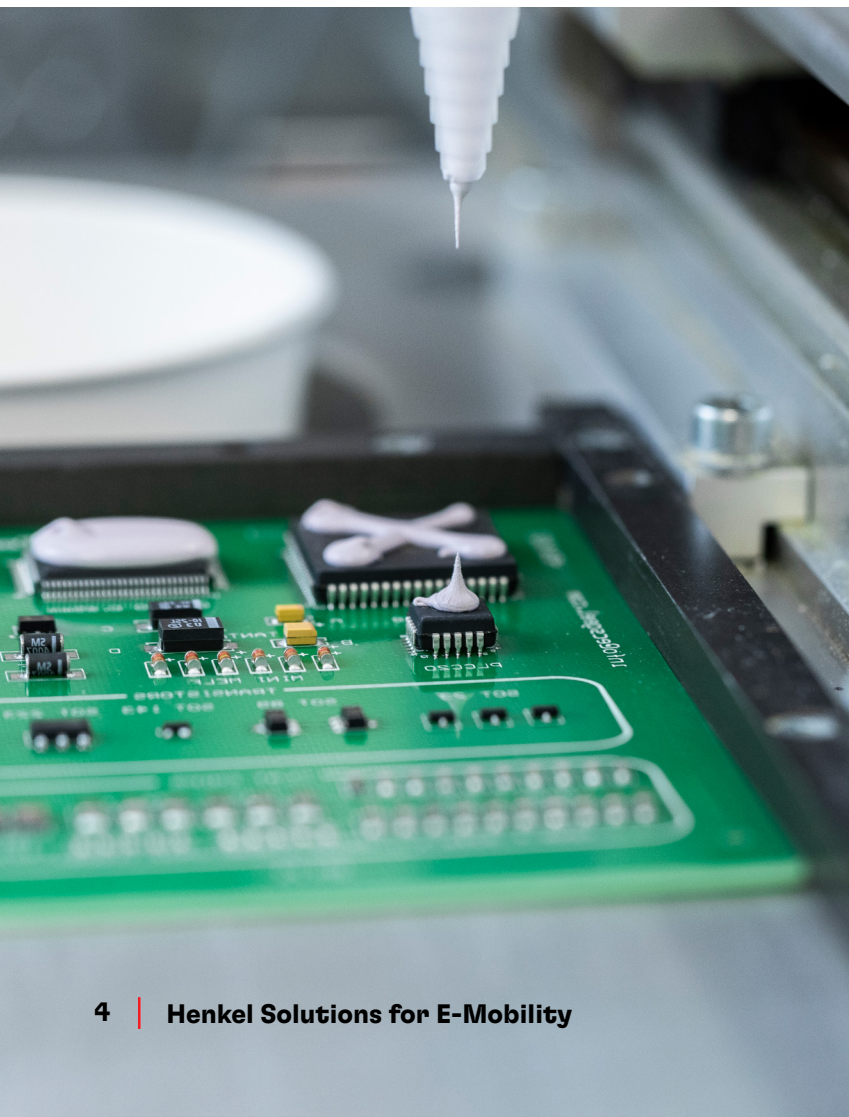
2. PROCESS EXPERTISE

With over 60 years of experience in the automotive industry, our global team of solution engineers has an unparalleled application and process understanding. Our team offers dedicated support to co-develop sustainable production processes that meet large-scale manufacturing requirements.

3. EQUIPMENT SUPPORT

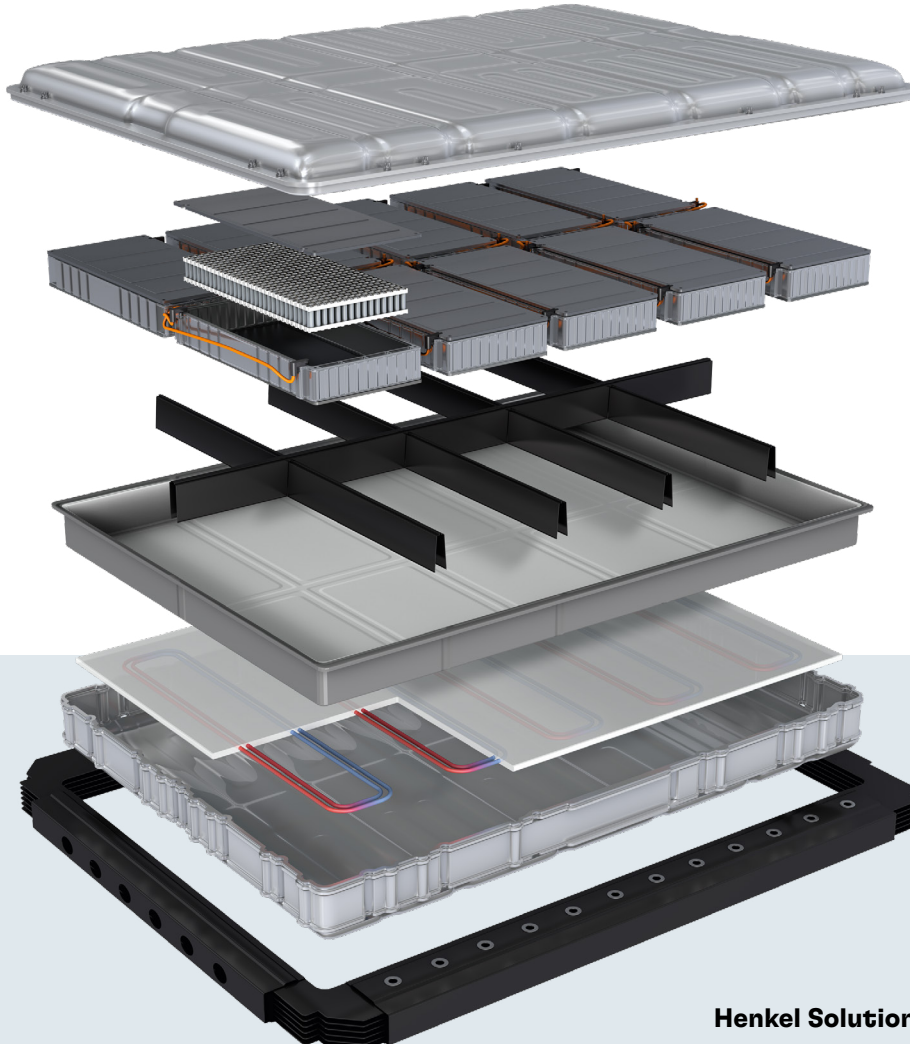
In addition to offering specialized dispensing equipment from Sonderhoff, we also partner with a global network of leading dispensing equipment suppliers, with which we collaborate to support our customer projects. Moreover, our labs are equipped with the latest technology and equipment for modeling, simulation and mechanical validation.

INNOVATING FOR ZERO-EMISSION MOBILITY



HENKEL SOLUTIONS FOR EV BATTERY SYSTEMS

- 1. BATTERY SAFETY MATERIALS** page 07
Lid coatings, intercell potting and pads
- 2. BATTERY ASSEMBLY ADHESIVES** page 06
Cell-to-cell or cell-to-carrier
- 3. STRUCTURAL BONDING** page 06
Module structure to module tray
- 4. THERMAL INTERFACE MATERIALS** page 07
Battery module/cell to cooling plate
- 5. GASKETING** page 08
Top cover to lower tray
- 6. METAL PRETREATMENT** page 09
Battery pack housing
- 7. IMPREGNATION SERVICE** page 20
Aluminum casted top cover
- 8. CONDUCTIVE ELECTRODE COATINGS**
Battery cell current collectors



DISCOVER OUR PORTFOLIO FOR EV Battery Systems

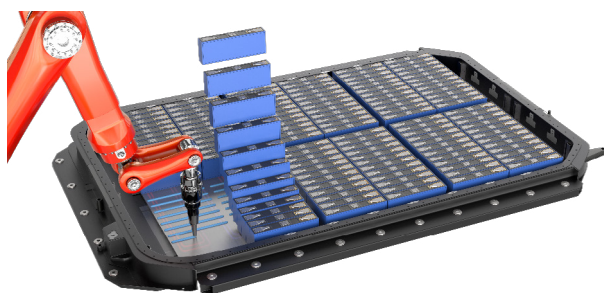
BATTERY ASSEMBLY & STRUCTURAL ADHESIVES

Product	Chemistry	Curing / Initial Strength	Bond Strength / Shear Strength (psi)	Key properties
<u>TEROSON® MS 9399</u>	Silane-modified polymer	RTV after mixing / 10 min at 60°C Handling time: 2 hr at RTV	290	Non-silicone, NCO-free, solvent-free, good adhesion to multiple substrates, high elasticity
<u>LOCTITE® AA 3963</u>	Acrylic	UV / Visible light / ≤ 10 sec	3,336	Quick cure, high strength, flexible open time
<u>TEROSON® EP 5065</u>	Epoxy	RTV / 15 min at 80°C Handling time: 8 hr at 23°C	3,625	Adhesion to multiple substrates, crash resistance
<u>TECHNOMELT® PS 1573E</u>	Synthetic-rubber	RTV / fast cure, sec to min	52	Pressure-sensitive adhesive
<u>LOCTITE® AA 3525</u>	Acrylic	UV / Visible light / < 30 sec	1,420	Quick cure, easy to handle, flexible open time
<u>LOCTITE® AA H8000</u>	Acrylic	RTV / 30 min	3,140	Flexible open time, good adhesion to multiple substrates
<u>TEROSON® PU 6700ME/6800</u>	Polyurethane	RTV / 120 min	1,450	Improves system overall stiffness (e-modulus > 500MPa), compatible with spot welding, Micro-Emission PU (label free)
<u>LOCTITE® UK 2015</u>	Polyurethane	RTV after mixing / 10 min at 20°C	2,900	Provides incremental stiffness, excellent adhesion to non-metallic surfaces

THERMAL INTERFACE MATERIALS

Product	Chemistry	Curing	Thermal conductivity	Key properties
BERGQUIST® TGF 2010 APS	Silane-modified polymer	RT or heat	2.0 W/mK	Non-silicone gap filler, high dispense rate (> 60 cc/sec), compressible (shore OO 60)
BERGQUIST® TGF 3010 APS	Silane-modified polymer	RT or heat	3.0 W/mK	Non-silicone gap filler, high dispense rate (> 80 cc/sec), UL94 V0, compressible (shore OO 75)
BERGQUIST® TGF 2200 APS	Silicone	RT or heat	2.2 W/mK	Low density gap filler, UL94 V0, compressible (shore OO 55)
BERGQUIST® TGP 1350	Silicone	Pre-cured	1.4 W/mK	GAP PAD®, compressible (shore OO 30), UL94 V0, high durability
LOCTITE® EA 9497	Epoxy	RT	1.4 W/mK	Thermally conductive adhesive, high stiffness and strength, multi-substrate bonding
LOCTITE® TLB 9200 APS	Polyurethane	RT or heat	2.0 W/mK	Thermally conductive adhesive for bonding battery cells or modules. Two-component, moderate viscosity, excellent electrical isolation and mid-range thermal conductivity
LOCTITE® TLB 9300 APSi	Polyurethane	RT or heat	3.0 W/mK	Thermally conductive adhesive for bonding battery cells or modules. Two-component, moderate viscosity, excellent electrical isolation, high thermal conductivity and bonding strength

Thermally Conductive Adhesives applied between the battery cells and the cooling system

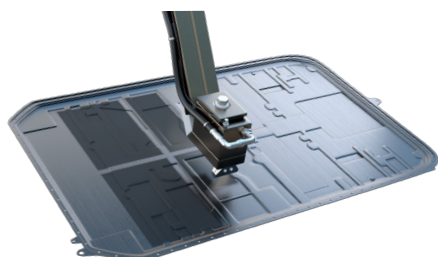


BATTERY SAFETY MATERIALS

Product	Chemistry	Curing	Thermal conductivity	Key properties
LOCTITE® EA 9400	Epoxy	RTV or heat	0.2 W/mK	Battery safety coating, intumescent, flat streaming and spray coating, coating thickness of 0.7 mm
LOCTITE® FPC 5060	Water-based inorganic	RTV or heat	0.7 W/mK	Battery safety coating, no chemical reaction during thermal abuse, no smoke formation during thermal abuse
LOCTITE® CR 6127/LOCTITE® CR 4300	Polyurethane	RTV or heat	0.6 W/mK	Battery safety potting, applicable between cells

RT = Room temperature curing

Battery safety coating applied to the battery pack lid



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GASKETING

Product	Chemistry	Curing	Serviceability	Flame retardancy (UL94 V0)	Key properties
LOCTITE® SI 5486	Silicone foam	FIPFG	Yes	Yes	Low compression set with excellent sealing and aging performance, exceeds UL94 V0
<u>LOCTITE®</u> <u>SI 5970</u>	Silicone	RTV / FIPG	Yes	Yes	High performance silicone gasket, MEKO-free, UL94 V0, high elongation to withstand joint movement, low volatility
<u>TEROSON®</u> <u>MS 939 FR</u>	Silane- modified polymer	RTV / FIPG	Yes*	No	Good moisture barrier, good elongation
LOCTITE® ESB 5100	Butyl	Non- reactive	Yes	No	Non-curing, permanent tacky, pumpable
TEROSON® MS 9320 SF	Silane- modified polymer	RTV / FIPG	No	No	Non-silicone, sprayable, low viscosity, weld sealant
<u>TEROSON®</u> <u>MS 930</u>	Silane- modified polymer	RTV / FIPG	Yes*	No (only UL94 HB)	High viscosity, weld sealant, non-silicone, paintable
SONDERHOFF FERMAPOR K31 SERIES	Polyurethane foam	RTV / FIPFG	Yes	No	Customizable, compressible, fast-cure, tolerance adaptable, complete system solution with dosing equipment
SONDERHOFF FERMASIL SERIES	Silicone foam	RTV / FIPFG	Yes	No	Customizable, compressible, water-resistant, tolerance adaptable, complete system solution with dosing equipment

FIPG = Formed-in-place gasket, CIPG = Cured-in-place gasket, RTV = Room-temperature-vulcanizing

*Tools required

Gasketing for battery pack housings

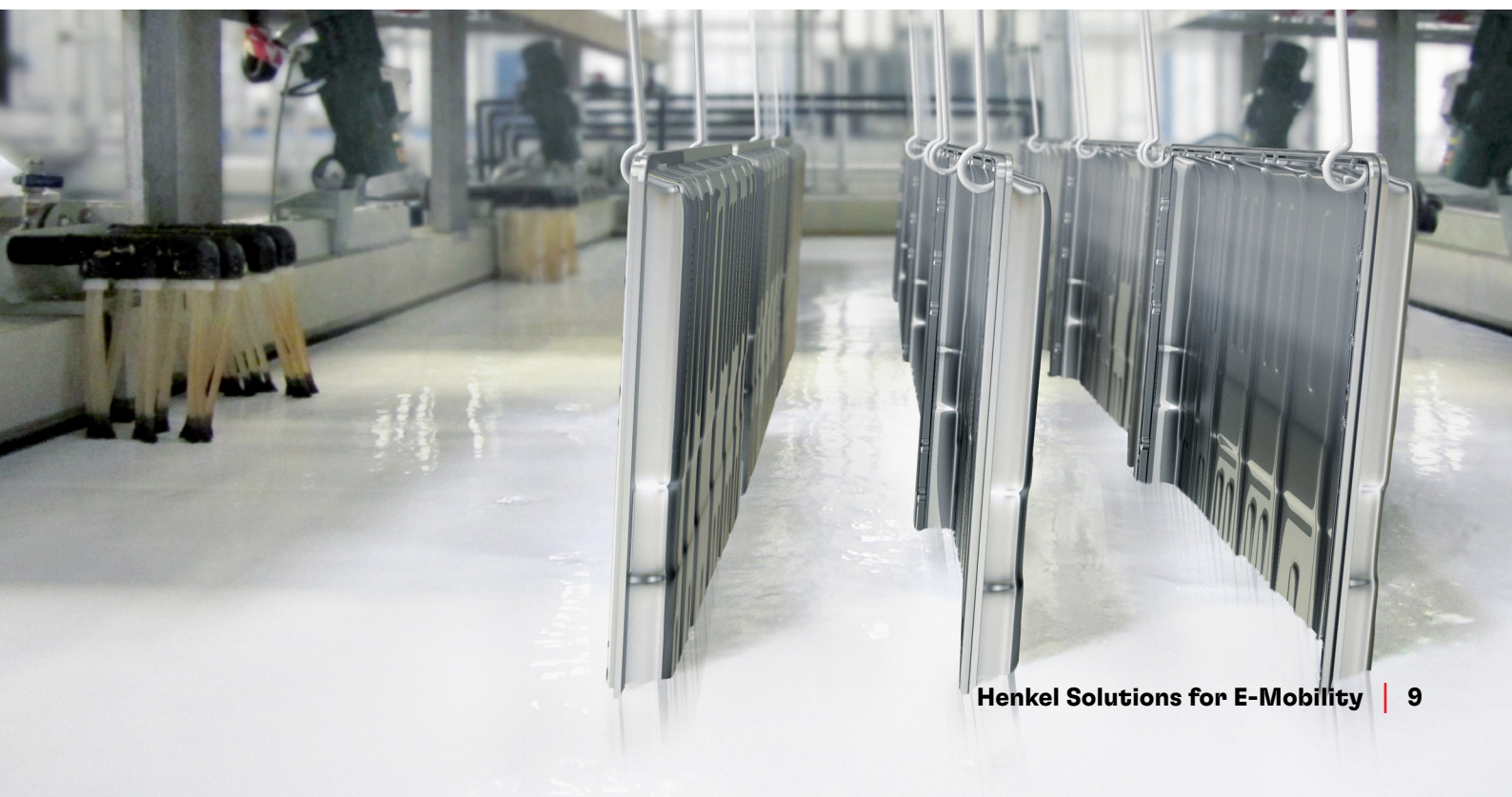


SURFACE TREATMENT

Tailor-made products for cell cases, battery modules, cooling plates, battery packs

Components	Henkel Solutions	Benefits
Battery Pack & Module	<ul style="list-style-type: none"> Mild, non-etching aluminum cleaners 	<ul style="list-style-type: none"> Clean and homogeneous surfaces, does not impact surface appearance
	<ul style="list-style-type: none"> Single stage etch-passivation as welding promoter 	<ul style="list-style-type: none"> Stable surface resistance Improves first pass rate of welding operations
	<ul style="list-style-type: none"> Pretreatment and conversion coatings for painting processes 	<ul style="list-style-type: none"> For excellent paint adhesion and corrosion performance
Cooling Plate	<ul style="list-style-type: none"> Alkaline cleaners, etchants and conversion coatings 	<ul style="list-style-type: none"> Removes residues from forming or brazing processes Clean and homogeneous surfaces for power paint or e-coat Provides excellent paint adhesion and corrosion resistance
Cylindrical Cell	<ul style="list-style-type: none"> Lubricants, cleaners and coatings for Ni-coated cylindrical cells 	<ul style="list-style-type: none"> High production speed, clean surfaces and corrosion protection
Prismatic Cell	<ul style="list-style-type: none"> Lubricants, cleaners and coatings for Aluminum prismatic cells 	<ul style="list-style-type: none"> High production efficiency, remove particles and forming residues, corrosion protection

Henkel's Surface Treatment Solutions for EV Systems are globally available. BONDERITE® products are specified by major OEMs and are typically available in 25 kg, 200 kg or 1000 kg packaging sizes.



CUSTOMER USE CASE

BERGQUIST® TGF 2010 APS

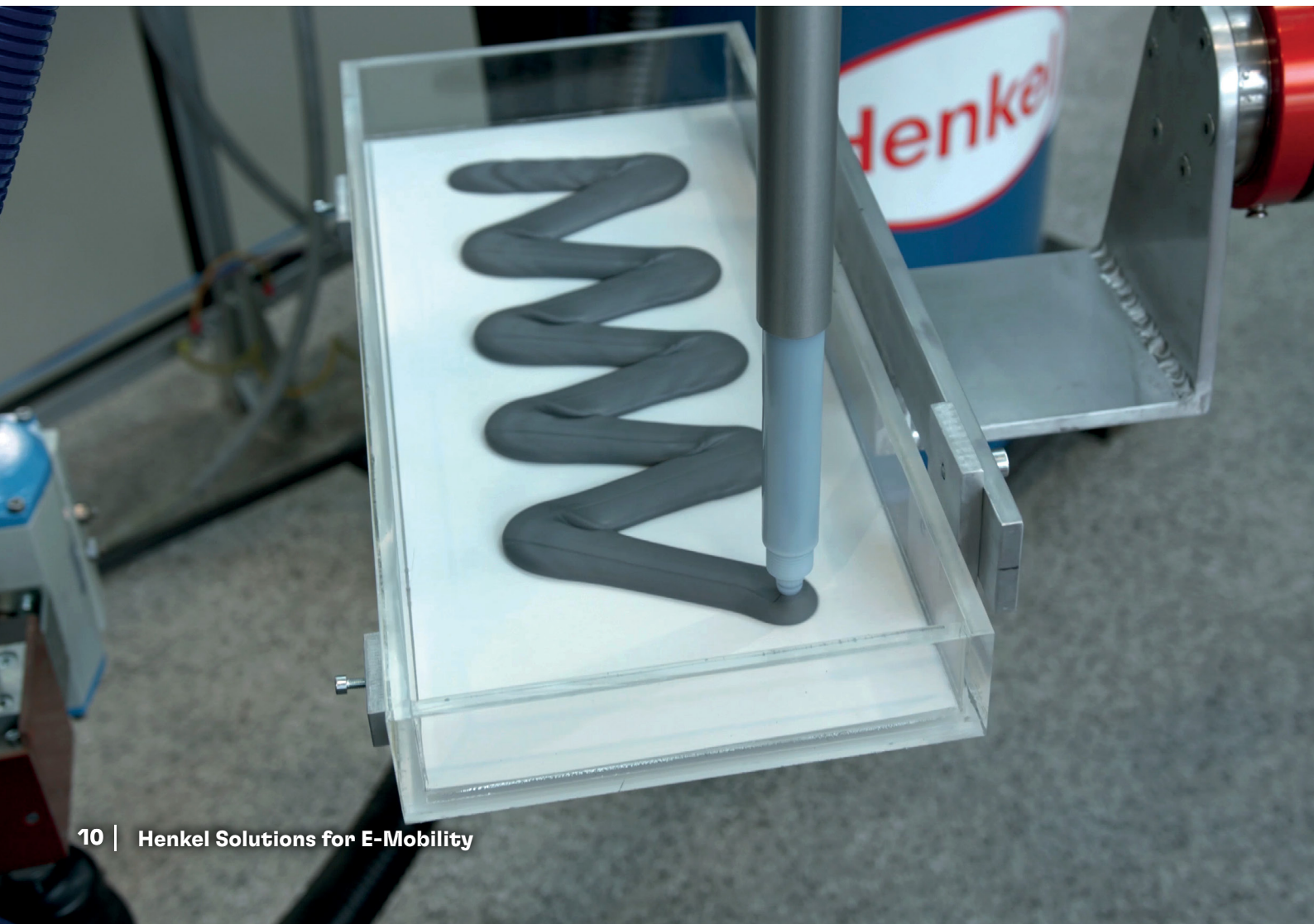
Silicone-free, Fast-dispensable Battery Thermal Management Solution

CUSTOMER CHALLENGES

- » Key global automotive OEM required a fast dispensable Gap filler solution that allows for optimizing the equipment maintenance cost.
- » To avoid the impact of any potential silicone outgassing, a silicone-free formulation was required.
- » To enable the reduction of cycle time, a low squeeze flow was required.

RECOMMENDED TECHNOLOGY

- » Henkel developed a two-component, silicone-free, liquid gap filler: BERGQUIST® TGF 2010 APS.
- » The product has a dispensing speed of >80 cc/second and is easily compressible.
- » The product has an optimal filler load and provides a thermal conductivity of 2.0 W/mK, allowing ample heat dissipation.

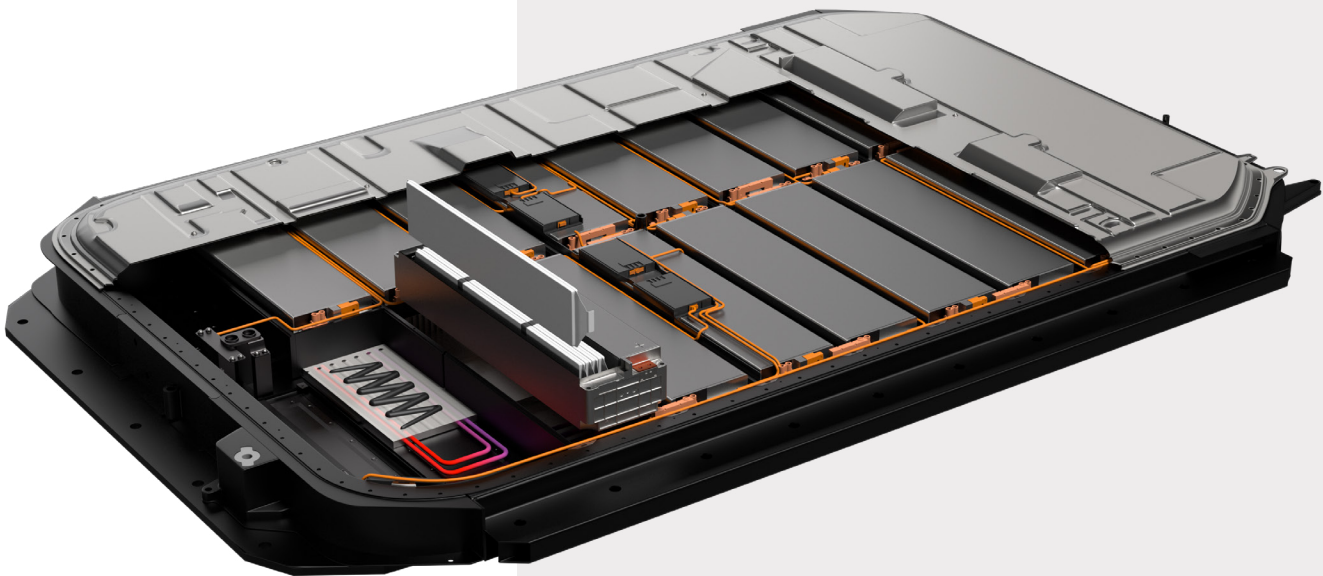


MASS PRODUCTION PROCESS SET-UP

- » Henkel's E-mobility experts provided the OEM with close technical support and on-site engineering support, helping them scale up quickly and efficiently with the new solution.
- » With an application time of < 60 seconds, the OEM has the capability to produce > 800 battery packs a day on one production line.
- » Through trustful collaboration with the OEM and the dispensing equipment supplier, Henkel ensured the successful implementation of the solution in accordance with all the customer requirements.

CUSTOMER BENEFITS

- » High dispense rate of 80 cc/second and application time < 60 seconds
- » Silicone free formulation to avoid impact on optical, electrical contact for surface painting functionality
- » Optimized filler package with low abrasion characteristics



HENKEL SOLUTIONS FOR Power Conversion Systems

1. POTTING MATERIALS

PCB/induction coils

page 14

2. GAP PAD®

Heat source or heat sink

page 13

3. GAP FILLER

Component/PCB to housing or heat sink

page 14

4. THERMAL CONDUCTIVE ADHESIVES

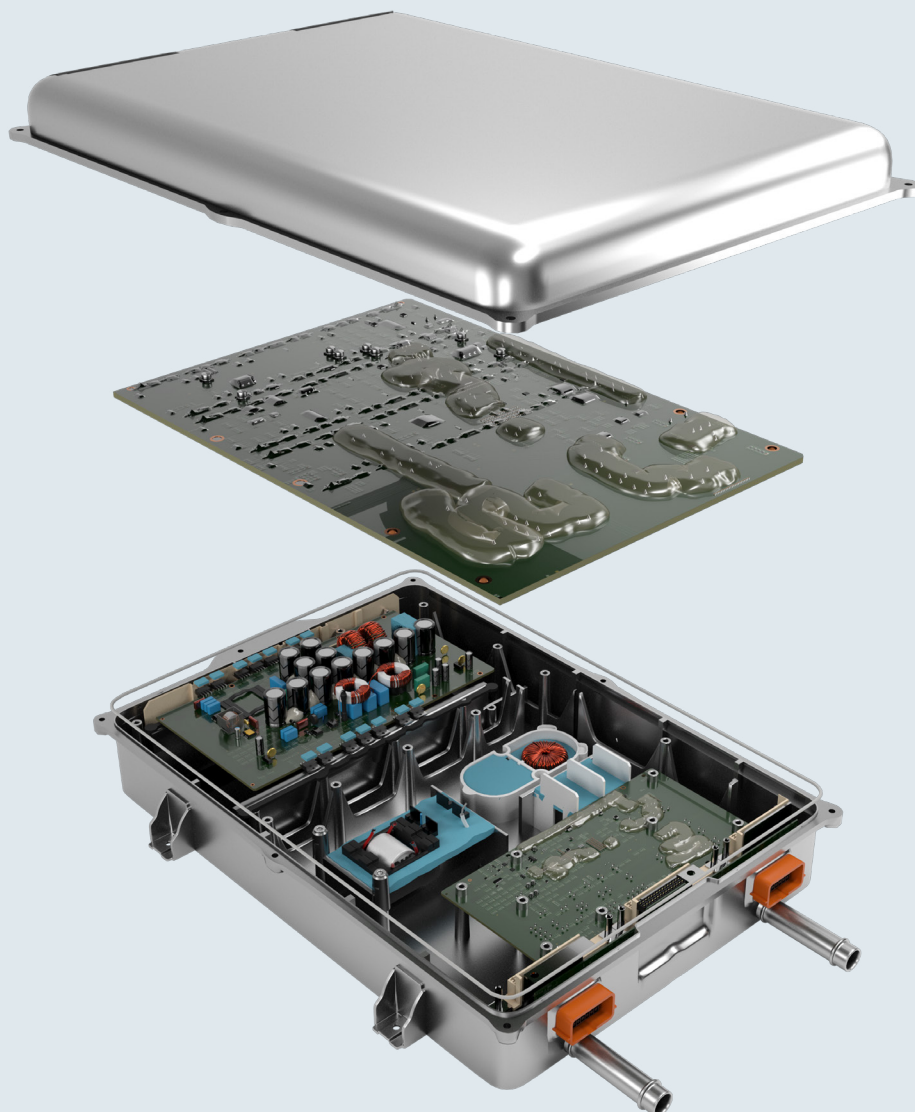
Printed circuit board

page 13

5. GASKETING

Top cover to lower tray

page 15



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Power Conversion Systems

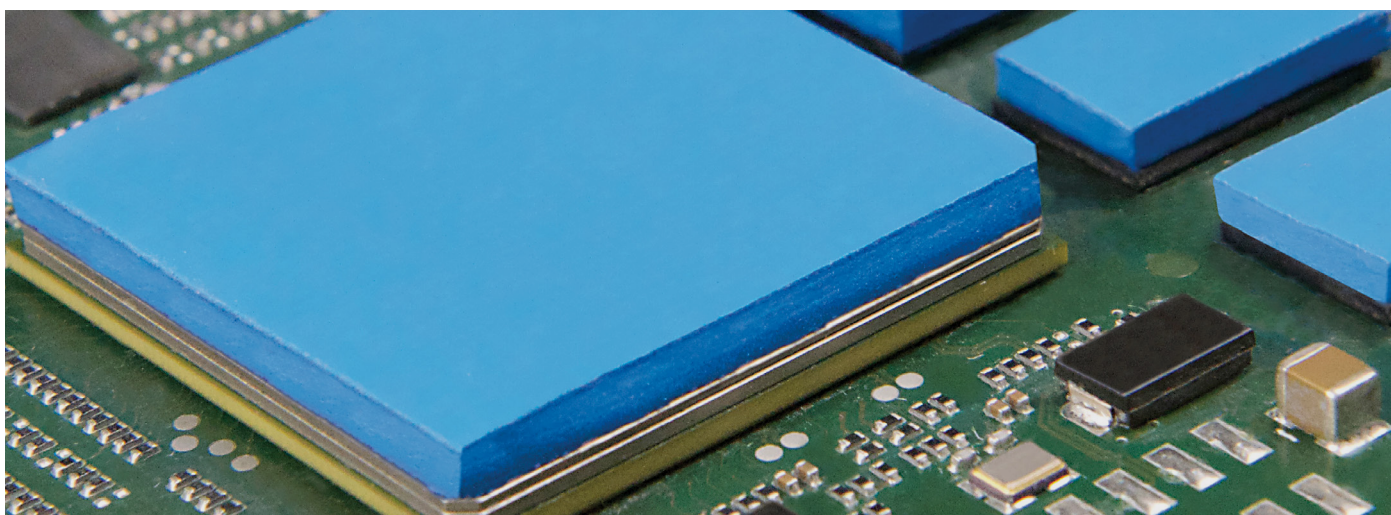
THERMALLY CONDUCTIVE ADHESIVES

Product	Chemistry	Curing	Thermal conductivity	Key properties
<u>BERGQUIST® TLB SA2005RT</u>	Silicone	RT or heat	2.0 W/mK	High elongation, UL94 V0 compliance
<u>BERGQUIST® TLB SA3500</u>	Silicone	Heat (125°C 20 min; 150°C 10 min)	3.5 W/mK	Good flexibility, UL94 V0
<u>BERGQUIST® TLB EA1800</u>	Epoxy	Heat	1.8 W/mK	UL94 V0, high strength, chemical stability

GAP PAD®

Product	Thermal conductivity	Dielectric breakdown voltage	Hardness / Young's Modulus	Key properties
<u>BERGQUIST® TGP 1000HD</u>	1.0 W/mK	5,000 V at 0.5 mm	Shore 00 = 15 / YM = 16 psi	For high-voltage application. Robust polyamide carrier provides excellent voltage breakdown, puncture and tear resistance
<u>BERGQUIST® TGP 1000VOUS</u>	1.0 W/mK	6,000 V at 0.5 mm	Shore 00 = 5 / YM = 8 psi	Ultra-soft, self-tacky one side
<u>BERGQUIST® TGP HC3000</u>	3.0 W/mK	> 10,000 V at 0.5 mm	Shore 00 = 15 / YM = 16 psi	High compliance, low compression stress, fiberglass reinforced for shear and tear resistance
<u>BERGQUIST® TGP HC5000</u>	5.0 W/mK	5,000 V at 0.5 mm	Shore 00 = 35 / YM = 17.5 psi	Highest compliant, low volatility resin

GAP PAD®



DISCOVER OUR PORTFOLIO

Power Conversion Systems

GAP FILLERS

Product	Chemistry	Curing	Thermal conductivity	Key properties
BERGQUIST® TGF 2210	Silicone	Heat	2.2 W/mK	Low volatility for out-gassing-sensitive, easy to dispense, low density (2.06 g/cm ³), excellent mechanical and thermal stability from -40°C up to 150°C
<u>BERGQUIST®</u> <u>TGF 1500</u>	Silicone	RT or heat	1.8 W/mK	Low siloxane volatility, high temperature resistance
<u>BERGQUIST®</u> <u>TGF 3500LVO</u>	Silicone	RT or heat	3.6 W/mK	Low Young's Modulus, high dielectric isolation
<u>BERGQUIST®</u> <u>TGF 3600</u>	Silicone	RT or heat	3.6 W/mK	High thermal conductivity, ultra-low Young's Modulus
BERGQUIST® TGF 4000	Silicone	RT or Heat	4.0 W/mK	High performance, soft and vibration dampening, operating temperature – 60°C to + 200°C

RT = Room temperature curing

POTTING MATERIALS

Product	Chemistry	Thermal conductivity	Viscosity (mixed)	Key properties
<u>LOCTITE®</u> <u>SI 5631</u>	Silicone	1.0 W/mK	5,000 mPa·s	Excellent cavity filling, flexible and robust
LOCTITE® SI 5643	Silicone	1.5 W/mK	6,000 mPa·s	Ultra-soft, excellent flow performance
LOCTITE® SI 5636	Silicone	2.1 W/mK	5,500 mPa·s	Low stress, increased thermal conductivity
<u>LOCTITE®</u> <u>EA 9496</u>	Epoxy	1.7 W/mK	15,000 – 40,000 mPa·s	Room temperature and warm cure, low shrinkage
SONDERHOFF FERMADUR SERIES	Polyurethane	0.2 – 0.9 W/mK	500 – 200,000 mPa·s	Room temperature and warm cure, customizable, UL94 V0, multi-substrate adhesion

GASKETING

Product	Chemistry	Curing	Serviceability	Key properties
<u>LOCTITE®</u> <u>SI 5970</u>	Silicone	RTV / FIPG	Yes*	High temperature stability, good moisture barrier, multi-substrate bonding
<u>LOCTITE®</u> <u>SI 5421</u>	Silicone	RTV / FIPG	Yes*	EMI gasketing, high temperature stability, good moisture barrier, multi-substrate bonding
<u>LOCTITE®</u> <u>AA 5884</u>	Polyacrylate	UV / CIPG	Yes	Quick cure, durable for heavy duty applications, compressible for good sealing capability, ATF and high temperature resistance, non-silicone
<u>BERGQUIST®</u> <u>TLB 400SLT</u>	Silicone	RTV or heat / FIPG	Yes*	Highly elastic, water glycol-resistant, multi-substrate bonding, compatible with additional cure materials due to room temperature cure kinetics
<u>LOCTITE®</u> <u>AA 5820</u>	Polyacrylate	RTV / FIPG	Yes*	Durable for heavy duty applications, ATF and high temperature resistance, compatible with BERGQUIST® GAP FILLER
<u>LOCTITE®</u> <u>SI 5039</u>	Silicone	UV + Moisture / CIPG	Yes	Flexible cure mechanism, durable for heavy duty applications, multi-substrate bonding, compressible for good sealing capability, high temperature resistance
SONDERHOFF FERMAPOR K31 SERIES	Polyurethane foam	RTV / FIPFG	Yes	Customizable, compressible, fast-cure, tolerance adaptable, complete system solution with dosing equipment
SONDERHOFF FERMASIL SERIES	Silicone foam	RTV / FIPFG	Yes	Customizable, compressible, water-resistant, tolerance adaptable, complete system solution with dosing equipment

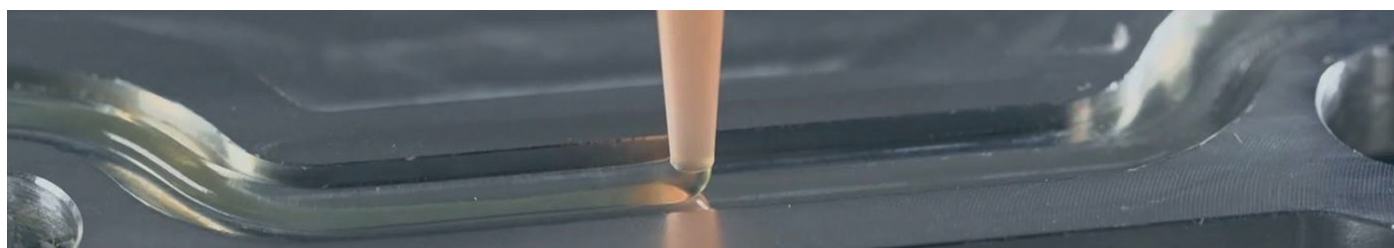
FIPG = Formed-in-place gasket, CIPG = Cured-in-place gasket, RTV = Room-temperature-vulcanizing

*Tools required

GAP FILLER



Cured-in-place gasketing material



CUSTOMER USE CASE

LOCTITE® SI 5970, BERGQUIST® TGF 3600, BERGQUIST® TGP 1000VOUS

CUSTOMER REQUIREMENT

- » A Tier 1 automotive supplier designed a new high-voltage EV inverter, which required reliable thermal management for safe and efficient function over lifetime.
- » Due to this nature of the inverter, which was designed to handle very high voltages, the Thermal Interface Materials (TIM) needed to be electrically insulating to avoid electrical hazards.
- » The compatibility of the gasketing and TIM chemistry was important, as multiple chemistries in the same component can cause contamination issues which could lead to curing and operational issues.

RECOMMENDED TECHNOLOGY

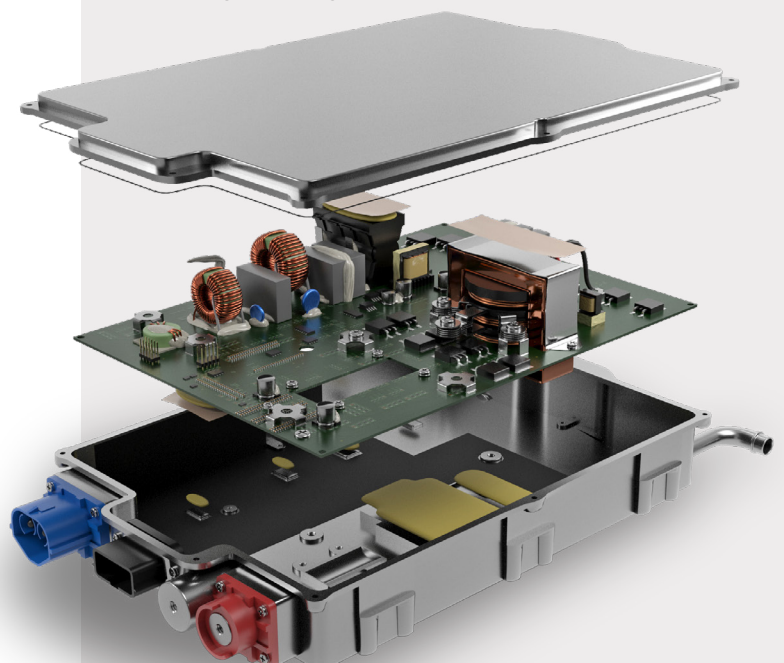
- » To fill larger, multi-level gaps, BERGQUIST® GAP FILLER TGF 3600 with 3.6 W/mK and 0.9 to 5.4 g/sec dispense rate was selected, as it was proven to perform reliably for an existing application.
- » Ultra-soft, conformable BERGQUIST® GAP PAD® TGP 1000VOUS was chosen as the solution for various components to provide thermal management along with providing high voltage breakdown strength to protect against high voltage surge.
- » LOCTITE® SI 5970 was recommended for sealing the inverter, as it is approved by multiple OEMs and Tier 1 Suppliers for its compatibility with other chemistries of gap filler and potting compounds.

PROCESS DESIGN/ PRODUCTION SET-UP

- » Leveraging Henkel's partnerships with multiple dispensing equipment suppliers, the customer was able to select the best dispensing equipment for the liquid gap filler.
- » To ensure GAP PAD® integrity, Henkel initiated an additional testing phase with a third-party laboratory to verify material cleanliness and purity in order to exclude any possibility of electrical shorts due to particle contamination.
- » This multi-material solution helped bring one of the EV industry's highest voltage inverters to commercialization, allowing an annual production capacity of > 500,000 inverters.

CUSTOMER BENEFITS

- » Reliable potting material performance
- » Process optimization by removing need for vacuum de-airing
- » Complete coverage of the coils and filling of all gaps



HENKEL SOLUTIONS FOR E-DRIVE SYSTEMS

1. GASKETING

E-Drive housing/ ECU housing

page 18

2. THERMAL POTTING

Induction coil

page 19

3. MAGNET BONDING

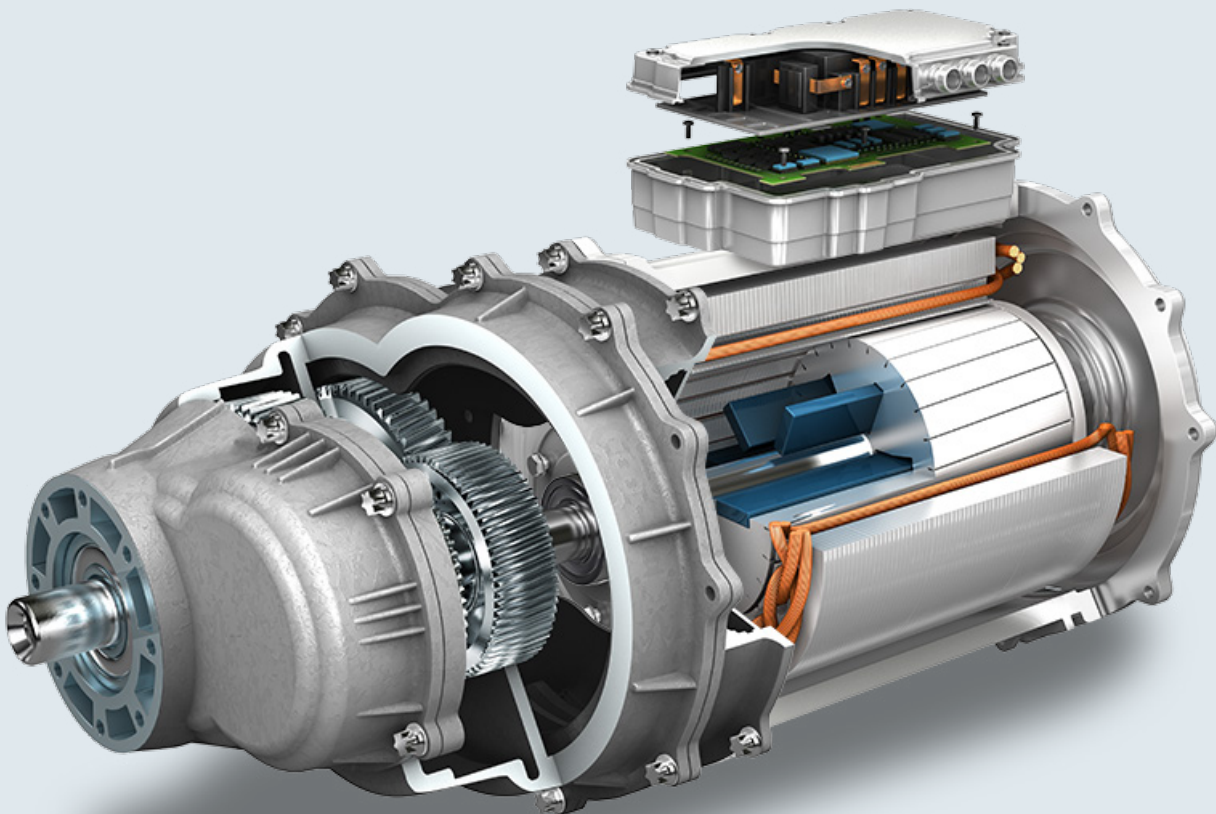
Magnet to stator

page 19

4. IMPREGNATION SERVICE

Aluminium casted housing

page 20



DISCOVER OUR PORTFOLIO FOR E-DRIVE SYSTEMS

GASKETING

Product	Chemistry	Curing	Serviceability	Processing time	Key properties
LOCTITE® AA 5821	Polyacrylate	RTV	No	25 - 45 min	Silicone-free, superior hot oil / ATF resistance, joint movement tolerant for sealing of flexible joints, non-sagging, easy to automate
<u>LOCTITE®</u> <u>AA 5884</u>	Polyacrylate	UV / CIPG	Yes	30 sec at 270 mW/cm ²	Durable for heavy duty applications, ATF and high temperature resistance, compatible with BERGQUIST® GAP FILLER
LOCTITE® SI 5970 BM	Silicone	RTV / FIPG	No	< 25 min	High temperature stability, good moisture barrier, multi-substrate bonding, bubble minimized, excellent oil resistance
<u>BERGQUIST®</u> <u>TLB 400SLT</u>	Silicone	RTV or heat	No	Yes	Highly elastic, water glycol-resistant, multi-substrate bonding, compatible with additional cure materials due to room temperature cure kinetics

POTTING MATERIAL

Product	Chemistry	Thermal value	Viscosity (mixed)	Key properties
LOCTITE® PE 1000LV	Epoxy	—	9,500 - 12,500 mPa·s at 60°C	Excellent oil resistance, good thermal shock resistance, good rheology performance
LOCTITE® PE 8083	Epoxy	1.0 W/mK	15,000 - 25,000 mPa·s at 60°C	High lap shear strength (20 MPa), high decomposition temperature (350°C)
LOCTITE® PE 8086	Epoxy	1.5 W/mK	1,400 mPa·s at 60°C	Thermal stability (180°C), excellent crack resistance
LOCTITE® SI 5631	Silicone	1.0 W/mK	5,000 mPa·s	Low viscosity at room temperature, high elongation rate (> 180%)
LOCTITE® STYCAST 2850FT CAT 27-1	Epoxy	1.1 W/mK	150,000 mPa·s at 60°C	Small filler size to fill small gaps, good physical and chemical properties at high temperatures

MAGNET BONDING

Product	Chemistry	Thermal value	Viscosity (mixed)	Key properties
LOCTITE® 638	Acrylic	3 min at 60°C, then rest at RTV for 2 min	4,500	ATF resistance, high temperature resistance up to 200°C, multi-substrate bonding, 4,500 psi
LOCTITE® 648	Acrylic	3 min at 60°C, then rest at RTV for 2 min	3,900	ATF resistance, high temperature resistance up to 200°C, multi-substrate bonding, 3,900 psi
LOCTITE® STYCAST A 316-48	Epoxy	30 min at 100°C, or 5 min at 120°C	2,500	ATF resistance, high temperature resistance up to 180°C, good gap filling performance, high viscosity (50,000 mPa·s)

FIPG = Formed-in-place gasket, CIPG = Cured-in-place gasket, RTV = Room-temperature-vulcanizing

Thermal Potting



DISCOVER OUR PORTFOLIO FOR E-DRIVE SYSTEMS

HENKEL IMPREGNATION SERVICE

To impregnate porosities in aluminum casted components, Henkel offers **two main service solutions**:

1. ON-SITE IMPREGNATION

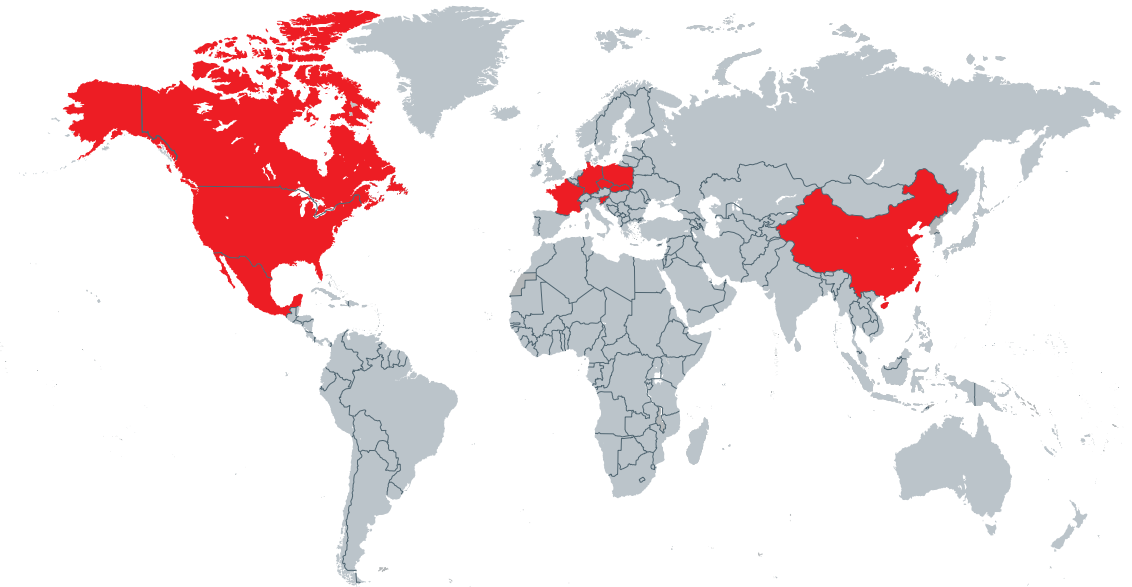
Temporary installation of a small but customized impregnation service center.

2. CLOSE-BY IMPREGNATION

Enjoy the advantages of our sealing solutions from an external impregnation service center located close-by your manufacturing plant.

LOCATIONS WORLDWIDE

- » Canada
- » China
- » Czech Republic
- » France
- » Germany
- » Mexico
- » Poland
- » Slovakia
- » Slovenia
- » USA



STEP 4



- » Rinsing of parts
- » Centrifuge prepares for curing step

STEP 3



- » Washing of parts
- » Centrifuge prepares for rinsing step

STEP 2



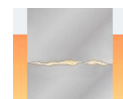
- » Drip-off and spin
- » Centrifuge removes excess sealant from part surfaces

STEP 5

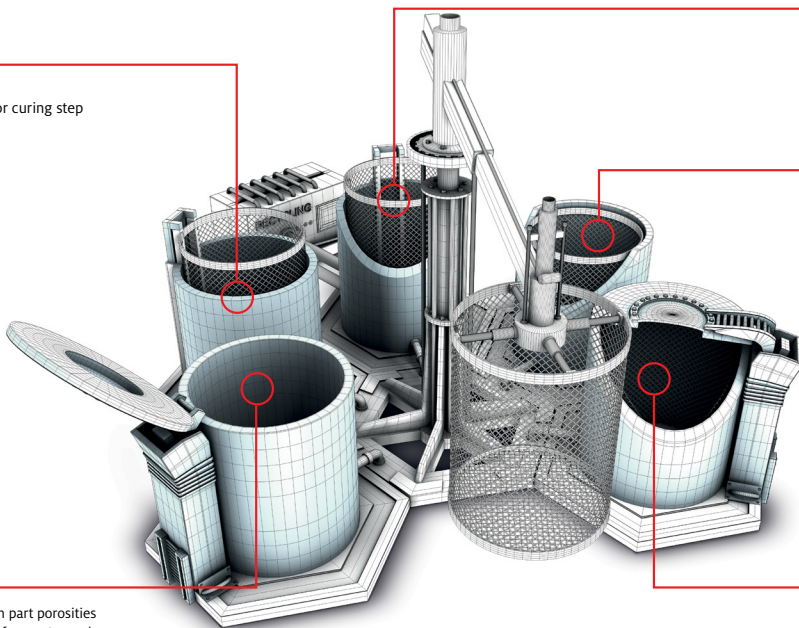


- » Curing of sealant within part porosities
- » Centrifuge removes surface water and dries parts

STEP 1



- » Dry vacuum
- » Wet vacuum
- » Sealant fills porosities, shrinkage cavities, capillary pores & cracks



CUSTOMER USE CASE

LOCTITE® PE 1000LV

E-MOTOR CONNECTOR RING POTTING PROTECTION AND STREAMLINED PRODUCTION

CUSTOMER CHALLENGES

- » A leading automotive supplier required a reliable potting solution for the stator of its new hybrid electric motor.
- » The material had to protect the ring's internal coils from physical damage, electrical shorts, moisture, automotive fluids and thermal shock.
- » The application process had to be optimized by removing the need for vacuum de-airing before dispensing and curing.

RECOMMENDED TECHNOLOGY

- » Henkel developed a new potting formulation, LOCTITE® PE 1000LV, which passed thermal shock testing without any cracks, exhibits excellent resistance to automatic transmission fluids and provides robust vibration endurance.
- » The rheology of the potting material strikes the right balance between self-leveling and thixotropic behavior.
- » As a result, it provides optimized filling of all spaces with deep penetration of the coils without any voids.

CUSTOMER BENEFITS

- » Component protection against environmental factors
- » Complete coverage of the coils and filling of all gaps
- » Process optimization by removing need for vacuum de-airing

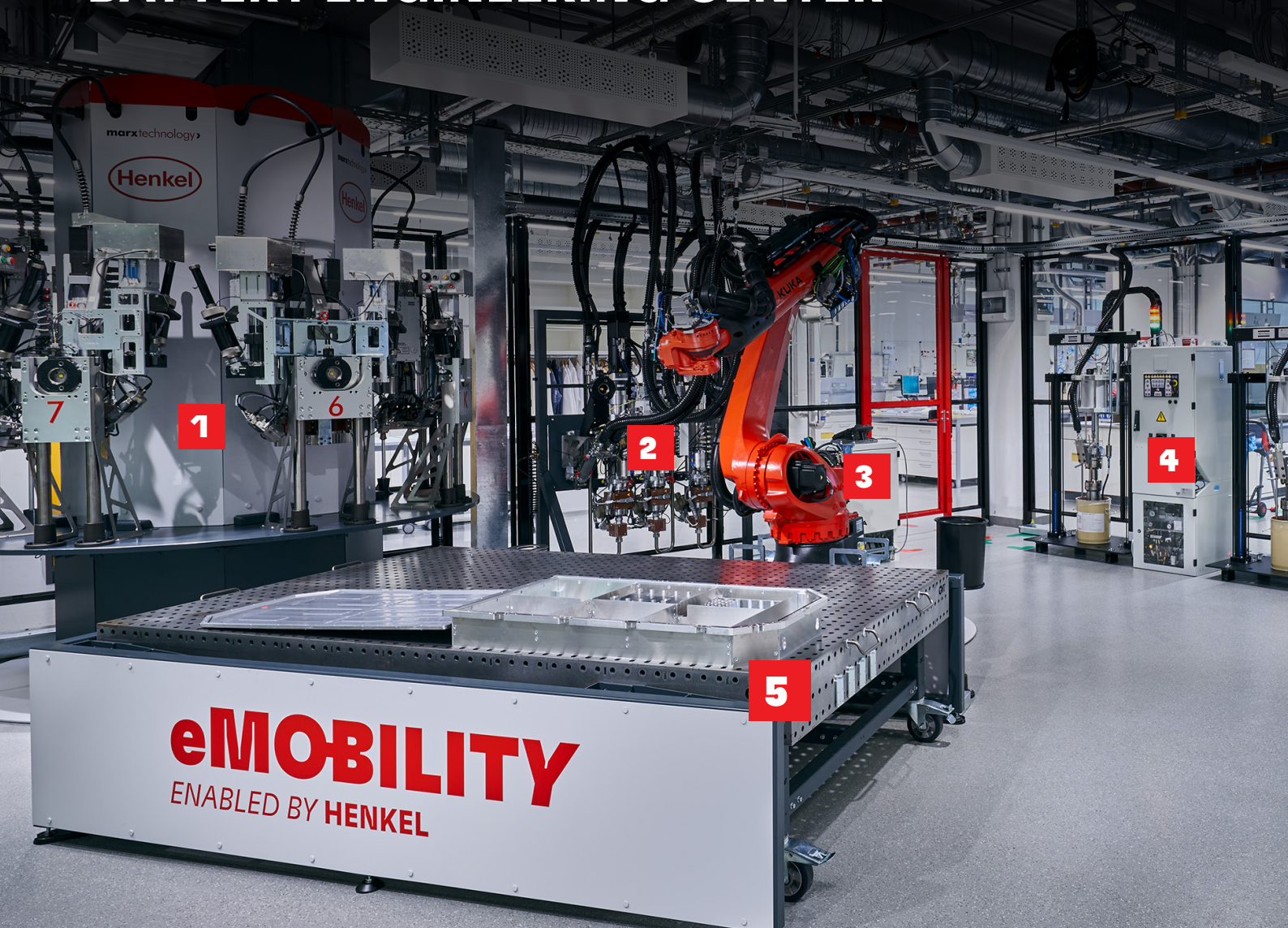
MASS PRODUCTION PROCESS SET-UP

- » Henkel formulated LOCTITE® PE 1000LV with significantly less bubbles, eliminating the need for vacuum de-airing before dispensing.
- » This new optimized application process allows to save approximately 40 minutes to one hour per shift.
- » The material allowed the Tier 1 supplier to increase the yield and successfully produce > 100,000 electric motors annually.

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DISCOVER HENKEL'S BATTERY ENGINEERING CENTER



- 1** 8 dispensers in turret magazine
- 2** 2 larger application units for flat streaming
- 3** Six-axis Kuka robot
- 4** Atlas Copco pumping station
- 5** Worktable of 2.4 x 1.6 m

AUTOMATED PRODUCTION-SCALE MATERIAL DISPENSING ON FULL-SCALE BATTERY SYSTEMS



MATERIAL SOLUTIONS

- » Thermal Gap Fillers
- » Thermally Conductive Adhesives
- » Battery Safety Coatings
- » Structural Adhesives
- » Gasketing Materials
- » Potting Materials



CHEMISTRIES

- » PU
- » Epoxy
- » Silicone
- » SMP/MS
- » Acrylics
- » Cold Butyls



APPLICATIONS

- » 1-component
- » 2-component
- » Flat stream



CERTIFICATIONS

- » Trusted Information Security Assessment Exchange (TISAX)



HENKEL'S BATTERY TEST CENTER



STATE-OF-THE-ART SIMULATIONS SOLUTIONS AND FULL-SCALE BATTERY SYSTEM TESTING



SIMULATION

- » Digital Twin of materials
- » Material cards
- » Structural & thermal performance



CERTIFICATIONS

- » Trusted Information Security Assessment Exchange (TISAX)



TESTING

- » Test rig with full end-of-line test capability
- » Fast charging up to 330 kWh and discharging back into the grid
- » Test rig combined with a climate chamber (*temperature range -40 to + 90°C, with 10 to 95% relative humidity*)
- » Active operation of battery liquid cooling during tests
- » Storage and emergency containers for HV batteries
- » Assembly and workshop area with electrical experts



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