LOCTITE®
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# HENKEL SOLUTIONS FOR E-MOBILITY

## BATTERY SYSTEMS, POWER CONVERSION SYSTEMS AND E-DRIVE SYSTEMS

Henkel

# eMOBILITY
*ENABLED BY* **HENKEL**





OUR AIM IS TO THOROUGHLY UNDERSTAND

# OUR CUSTOMERS' CHALLENGES AND NEEDS...

## BATTERY SYSTEMS

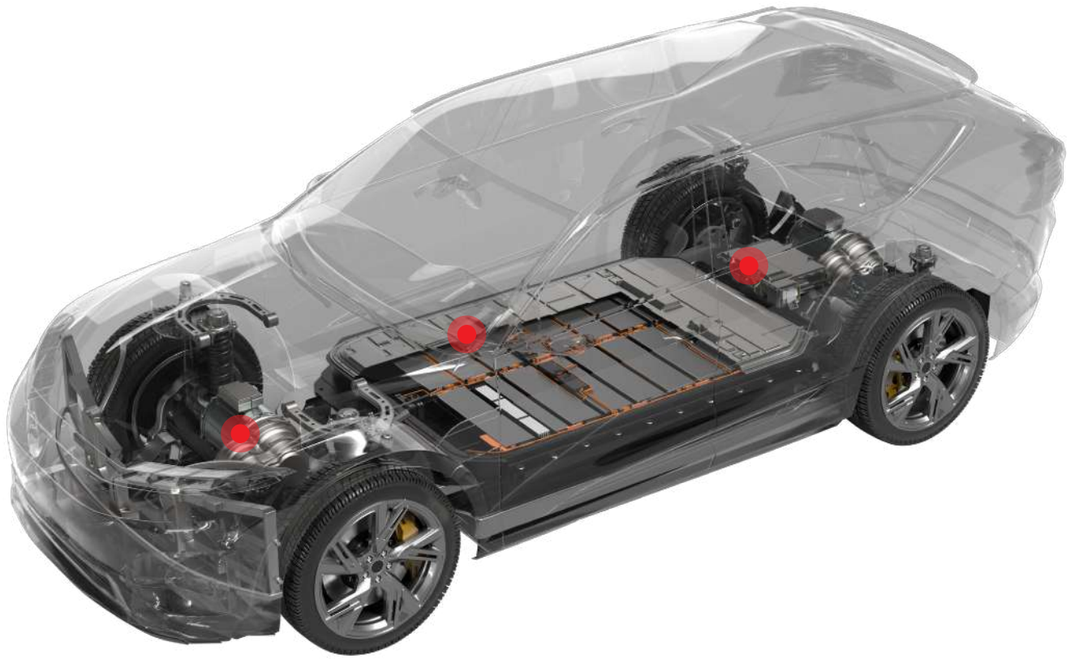
Battery systems are one of the most critical components of an electric vehicle (EV), accounting for approximately 20 – 30% of the vehicle's weight and up to 50% of its total cost. Key considerations for battery design include cost efficiency, thermal management, passenger safety, and circularity. These factors make efficient and secure component assembly—as well as effective thermal management—top priorities in battery system engineering and design.

## POWER CONVERSION SYSTEMS

Power conversion systems are sophisticated electronic components that manage high-voltage DC and AC currents under harsh electrical and environmental conditions. Effective sealing, electrical insulation, and thermal management are critical to protect sensitive electronics, ensuring system efficiency, safety, and long-term reliability across the electric vehicle's lifespan.

## E-DRIVE SYSTEMS

Electric motors in EVs are regularly exposed to mechanical vibration, thermal cycling, and challenging environmental conditions. As one of the few systems with moving parts, ensuring structural integrity, reliable sealing, and effective thermal management is essential for maintaining consistent performance and durability.



# *INNOVATING* FOR *ZERO-EMISSION MOBILITY*

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

## 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.

## 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.

## EQUIPMENT SUPPORT

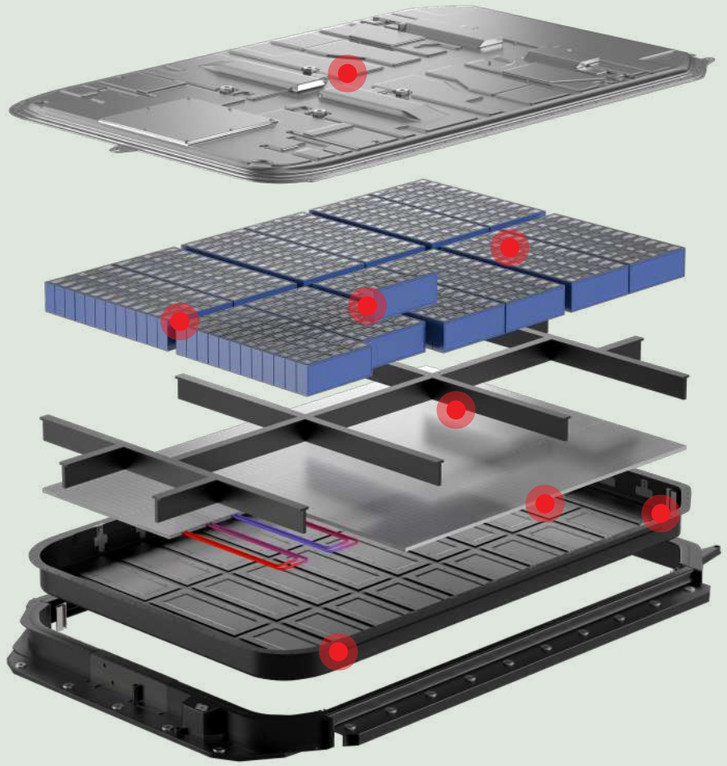
In addition to offering specialized dispensing equipment from Sonderhoff, we also partner with a global network of leading dispensing equipment suppliers, with which we collaborate to support our customer projects. Moreover, our labs are equipped with the latest technology and equipment for modeling,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



HENKEL SOLUTIONS FOR

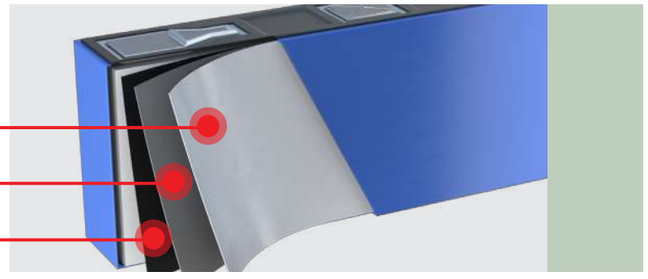
# EV BATTERY SYSTEMS





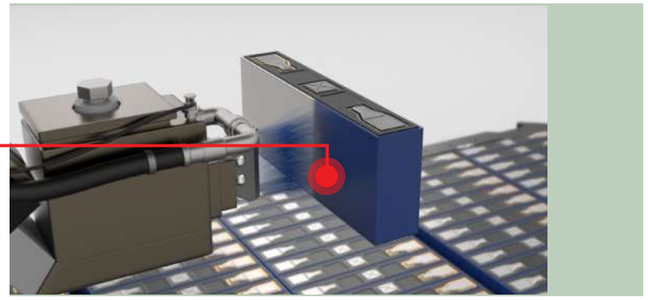
DISCOVER OUR PORTFOLIO FOR

# EV BATTERY SYSTEMS




## BATTERY CONDUCTIVE COATINGS

| Product | Carrier | Viscosity | Sheet Resistance | Key properties |
|---|---|---|---|---|
| BONDERITE® B-CC 1020 | Water | 50 – 500 mPa•s | < 50 Ω/sq at 25 um | Conductive coating developed for lithium-ion battery dry coating process providing adhesion of electrode materials to the current collector. |
| BONDERITE® B-CC 2200 | Water | 50 – 500 mPa•s | < 50 Ω /sq at 25 um | Conductive coating developed for lithium-ion battery applications providing adhesion of electrode materials to the cathode. |




## DIELECTRIC COATINGS

| Product | Technology | Dielectric Strength | Lap Shear & Tensile Strength | Key properties |
|---|---|---|---|---|
| BONDERITE® B-DC 5100 | UV Acrylate | > 90 kV/mm | > 10 MPa | Thin dielectric coating with enhanced thermal conductivity and low thermal impedance for electrical insulation in battery cells and cooling plates. |



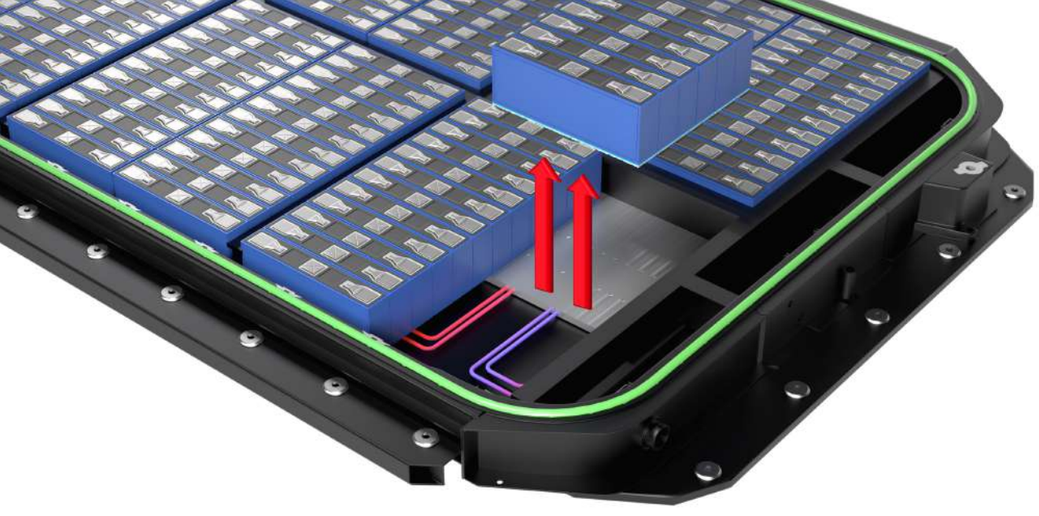

## THERMAL INTERFACE MATERIALS

| Product | Chemistry | Curing | Thermal conductivity | Key properties |
|---|---|---|---|---|
| BERGQUIST® TGF 2010 APS | Silane-modified polymer | RT or heat | 2.1 W/mK | Non-silicone gap filler, high dispense rate (>40 cc/sec). |
| BERGQUIST® TGF 3015 APS | Silane-modified polymer | RT or heat | 3.0 W/mK | Non-silicone gap filler, high dispense rate (> 40 cc/sec). |
| BERGQUIST® TGF 2025 APS | Silane-modified polymer | RT or heat | 2.0 W/mK | Non-silicone gap filler, high dispense rate (> 40 cc/sec) designed for ultra-low compression force. |
| 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 | 1.3 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 9150 | Polyurethane | RT or heat | 1.3 W/mK | Thermally conductive adhesive, high dispense rate, solvent free, long open time and fast adhesion build. |
| 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 | 3.1 W/mK | Thermally conductive adhesive for bonding battery cells or modules. Two-component, moderate viscosity, excellent electrical isolation, high thermal conductivity and bonding strength. |

RT = Room temperature curing

## BATTERY SAFETY MATERIALS

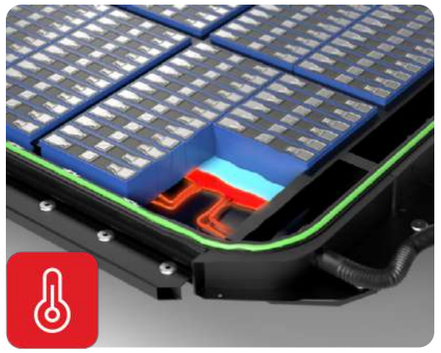
| Product | Chemistry | Curing | Thermal conductivity | Key properties |
|---|---|---|---|---|
| LOCTITE® BSX 5200 | Silicone | RT | 0.32 W/mK | Battery safety potting for cell contact, vent protection, and thermal propagation prevention. |
| LOCTITE® BSC NEXT-GEN | Not published | RT | < 0.5 W/mK | Battery safety coating, providing heat stability, mechanical strength, and electrical insulation. |



ENABLING CIRCULARITY WITH

# DEBONDABLE BATTERY ADHESIVES

Henkel is pioneering a new generation of battery adhesives designed for debonding at end-of-life. These solutions support circularity by enabling easier battery pack repair, reuse, and recycling—without compromising structural integrity during use.



## THERMAL TRIGGER

Debonding is activated by applying heat, which causes the adhesive's polymer structure to soften, expand, or decompose in a controlled way. This reduces adhesion strength and allows bonded parts—such as cells, covers, or modules—to be separated without damage. Ideal for disassembly processes that involve uniform heating.

## ELECTRICAL TRIGGER (ELECTRICAL DELAMINATION)

Debonding is initiated using an electrical current that creates a weak boundary layer within the adhesive interface. This leads to interfacial accumulation and separation, allowing bonded components to delaminate cleanly. The process enables selective, localized disassembly without the need for external heat or mechanical force.

## BATTERY ASSEMBLY & STRUCTURAL ADHESIVES

| Product | Chemistry | Curing / Initial Strength | Bond Strength / Shear Strength (psi) | Key properties |
|---|---|---|---|---|
| TEROSON® MS 9399 | Silane-modified polymer | Room temperature cure after mixing / 10 min at 60°C Handling time: 2 hr at room temperature cure | 290 | Non-silicone, NCO-free, solvent-free, good adhesion to multiple substrates, high elasticity. |
| LOCTITE® AA 3963 | Acrylic | UV / Visible light / ≤ 10 sec | 3,336 | Quick cure, high strength, flexible open time. |
| TEROSON® EP 5065 | Epoxy | Room temperature cure / 15 min at 80°C Handling time: 8 hr at 23°C | 3,625 | Adhesion to multiple substrates, crash resistance. |
| TECHNOMELT® PS 1573E | Synthetic-rubber | Room temperature cure / fast cure, sec to min | 52 | Pressure-sensitive adhesive. |
| LOCTITE® AA 3525 | Acrylic | UV / Visible light / < 30 sec | 1,420 | Quick cure, easy to handle, flexible open time. |
| LOCTITE® AA H8000 | Acrylic | Room temperature cure / 30 min | 3,140 | Flexible open time, good adhesion to multiple substrates. |
| TEROSON® PU 6700ME/6800 | Polyurethane | Room temperature cure / 120 min | 1,450 | Improves system overall stiffness (e-modulus > 500MPa), compatible with spot welding, Micro-Emission PU (label free). |
| LOCTITE® UK 2015 | Polyurethane | Room temperature cure after mixing / 10 min at 20°C | 2,900 | Provides incremental stiffness, excellent adhesion to non-metallic surfaces. |
| LOCTITE® UK 2018 | Polyurethane | Room temperature cure / 4 – 5 min | 1,740 | Fast strength build-up; designed for structural bonding in battery module and cell assembly. UL94 V0 rated. |

DISCOVER OUR PORTFOLIO FOR

# EV BATTERY SYSTEMS

Gasketing for battery pack housings

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.

## 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. |
| LOCTITE® SI 5970 | Silicone | RTV / FIPG | Yes | Yes | High performance silicone gasket, MEKO-free, UL94 V0, high elongation to withstand joint movement, low volatility. |
| TEROSON® MS 939 FR | 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. |
| TEROSON® MS 930 | 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

## SURFACE TREATMENT

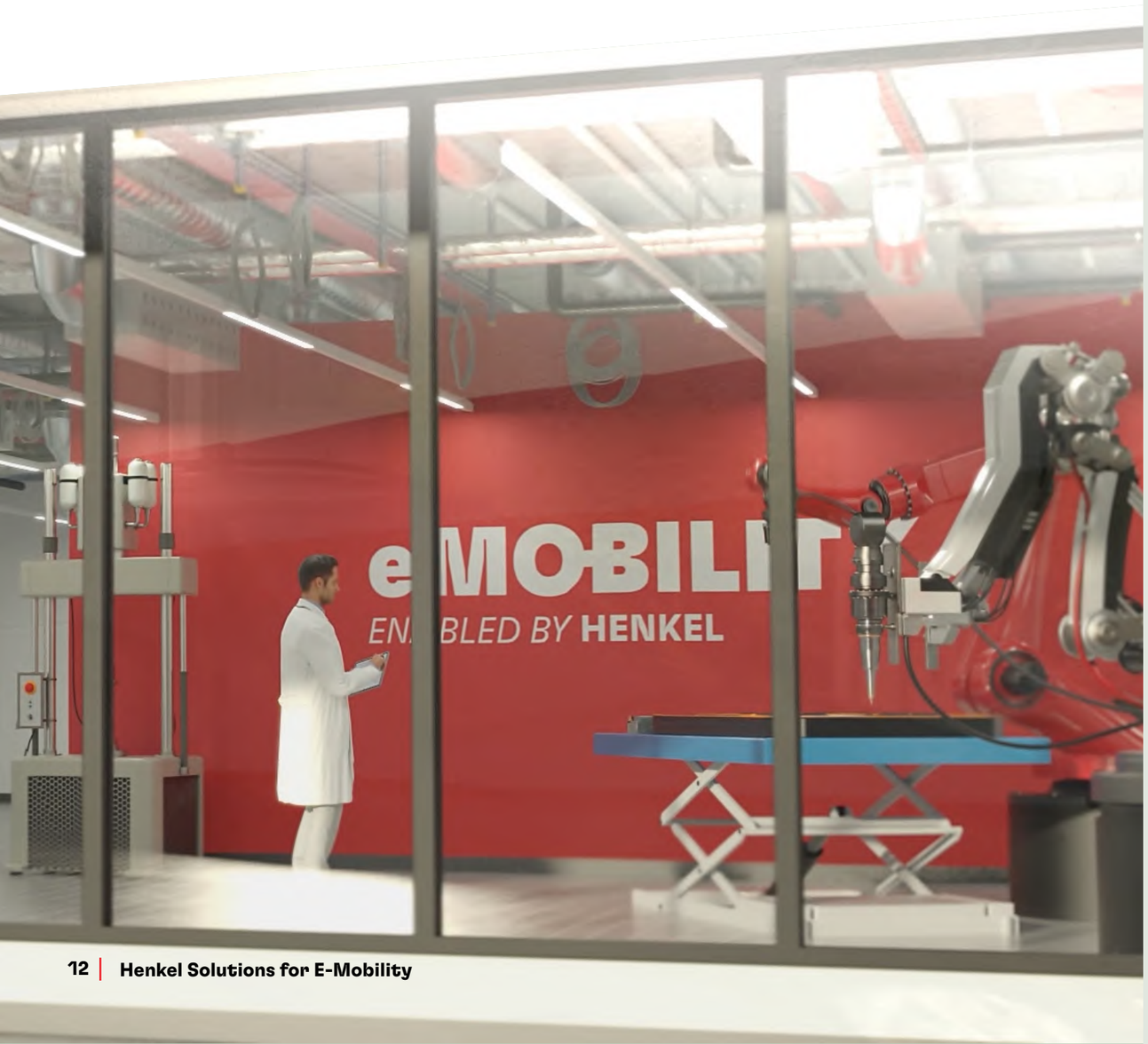
Tailor-made products for cell cases, battery modules, cooling plates, battery packs

| Components | Henkel Solutions | Benefits |
|---|---|---|
| Battery Pack & Module | ▪ Mild, non-etching aluminum cleaners | ▪ Clean and homogeneous surfaces, does not impact surface appearance |
| | ▪ Single stage etch-passivation as welding promoter | ▪ Stable surface resistance<br>▪ Improves first pass rate of welding operations |
| | ▪ Pretreatment and conversion coatings for painting processes | ▪ For excellent paint adhesion and corrosion performance |
| Cooling Plate | ▪ Alkaline cleaners, etchants and conversion coatings | ▪ Removes residues from forming or brazing processes<br>▪ Clean and homogeneous surfaces for power paint or e-coat<br>▪ Provides excellent paint adhesion and corrosion resistance |
| Cylindrical Cell | ▪ Lubricants, cleaners and coatings for Ni-coated cylindrical cells | ▪ High production speed, clean surfaces and corrosion protection |
| Prismatic Cell | ▪ Lubricants, cleaners and coatings for Aluminum prismatic cells | ▪ High production efficiency, remove particles and forming residues, corrosion protection |

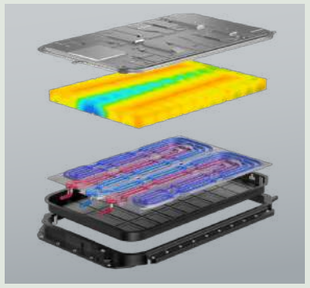
# BATTERY MODELING AND *SIMULATION*

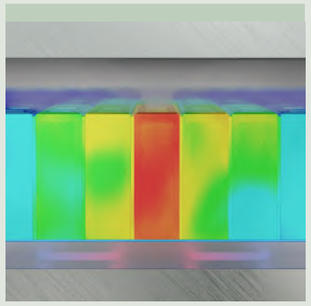
## ACCELERATING BATTERY INNOVATION WITH MODELING AND SIMULATION

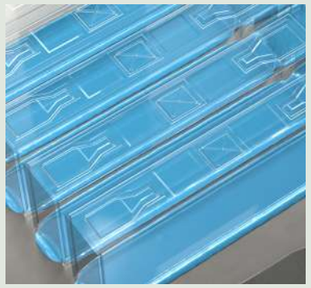
Henkel supports OEMs and battery manufacturers with optimizing EV battery design by offering advanced modeling, simulation, and testing solutions. By engaging early in the design phase, Henkel enables informed material selection and reduces development time and costs—ensuring high-performance, safe, and sustainable battery systems. Our deep automotive expertise, AI-generated virtual adhesives, and physical validation capabilities make Henkel a trusted innovation and engineering partner in the shift toward e-mobility.









## COMPREHENSIVE MATERIAL DATA CARDS FOR ADVANCED BATTERY DESIGN

Henkel provides detailed material cards with mechanical, thermal, and rheological data to help engineers accurately simulate battery behavior. These datasets enable predictive modeling of energy density, thermal management, and structural integrity across different load cases and operating conditions.

## BATTERY STRUCTURAL SIMULATION

Simulations evaluate the mechanical performance of materials under impact, crush, and vibration scenarios. By identifying failure points and optimizing material properties, Henkel supports the development of safer and more robust battery pack designs.

## BATTERY THERMAL SIMULATION

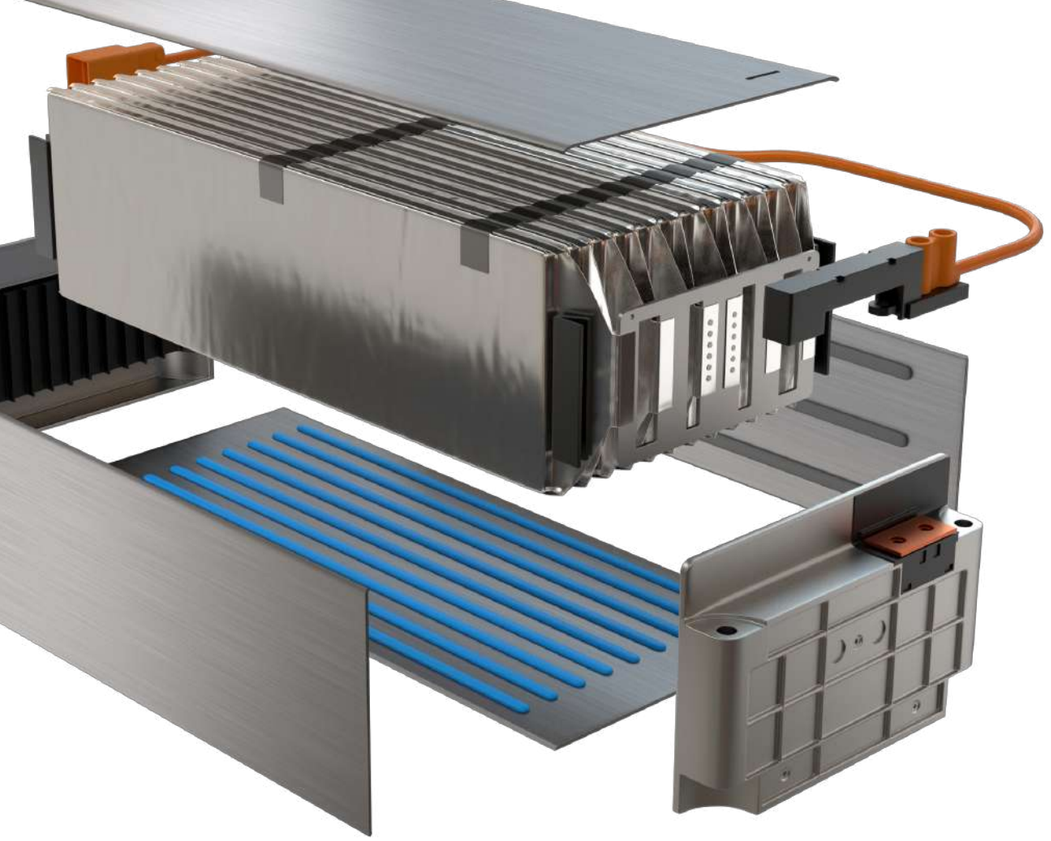
Henkel's thermal models assess how materials manage heat during fast charging, acceleration, and extreme temperatures. These insights guide the selection of thermal interface materials to prevent overheating and improve system efficiency and safety.

## BATTERY THERMAL EVENT SIMULATION

Henkel simulates battery abuse scenarios, such as thermal runaway, to evaluate the performance of its safety materials. These simulations help prevent fire propagation and ensure passenger safety by validating materials under the most demanding conditions.

## BATTERY MATERIAL APPLICATION SIMULATION

Henkel models adhesive and sealant dispensing to optimize application processes. By predicting flow behavior, squeeze-out, and curing effects, these simulations minimize assembly risks and ensure consistent performance across the battery pack.



CUSTOMER USE CASE

# LOCTITE® TLB 9300 APSi

**Two-component polyurethane thermally conductive adhesive for EV battery systems**

## CUSTOMER CHALLENGES

» A major global EV battery manufacturer required an injectable thermally conductive adhesive solution that allows for bonding cell stacks into the battery module.

» A high thermal conductivity of 3 W/mK was required to ensure efficient heat dissipation from the battery cells to the cooling system.

» A high lap shear strength to aluminum and PET foil was also a key requirement to ensure the structural integrity of the battery cells and module.



## RECOMMENDED TECHNOLOGY

» Henkel developed a two-component polyurethane thermally conductive adhesive: LOCTITE® TLB 9300 APSi.

» The product has a moderate viscosity to fill cavities in pre-assembled modules, with fast curing at room temperature.

» The product has an optimal filler load and provides a thermal conductivity of 3 W/mK, allowing ample heat dissipation along with strong bonding performance.

## MASS PRODUCTION PROCESS SET-UP

» Henkel's E-Mobility experts provided the customer's teams with close technical and on-site engineering support, helping them scale up quickly and efficiently with the new solution.

» The solution enables the customer to produce > 10,000 battery modules a day on several production lines.

» Through trustful collaboration with the customer and the dispensing equipment supplier, Henkel ensured the successful implementation of the complex and multifunctional process solution using material and dispensing equipment, successfully meeting all the customer requirements.

## CUSTOMER BENEFITS

» High thermal conductivity of 3 W/mK

» High lap shear strength and suitability for multiple substrates

» Fast room temperature curing

» Injectable application

HENKEL SOLUTIONS FOR

# POWER CONVERSION SYSTEMS

**17** **THERMALLY CONDUCTIVE ADHESIVES**
Printed circuit board

**17** **GAP PAD®**
Heat source or heat sink

**18** **GAP FILLER**
Component/PCB to housing or heat sink

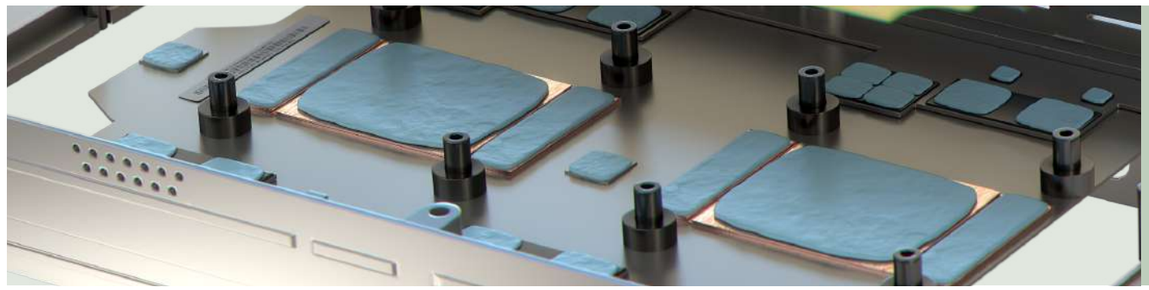
**19** **POTTING MATERIALS**
PCB/induction coils

**20** **GASKETING**
Top cover to lower tray



## THERMALLY CONDUCTIVE ADHESIVES

| Product | Chemistry | Curing | Thermal conductivity | Key properties |
|---|---|---|---|---|
| BERGQUIST® TLB SA2005RT | Silicone | RT or heat | 2.0 W/mK | High elongation, UL94 V0 compliance. |
| BERGQUIST® TLB SA3500 | Silicone | Heat (125°C 20 min; 150°C 10 min) | 3.5 W/mK | Good flexibility, UL94 V0. |
| BERGQUIST® TLB EA1800 | 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 |
|---|---|---|---|---|
| BERGQUIST® TGP 1000HD | 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. |
| BERGQUIST® TGP 1000V0US | 1.0 W/mK | 6,000 V at 0.5 mm | Shore 00 = 5 / YM = 8 psi | Ultra-soft, self-tacky one side. |
| BERGQUIST® TGP HC3000 | 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. |
| BERGQUIST® TGP HC5000 | 5.0 W/mK | 5,000 V at 0.5 mm | Shore 00 = 35 / YM = 17.5 psi | Highest compliant, low volatility resin. |

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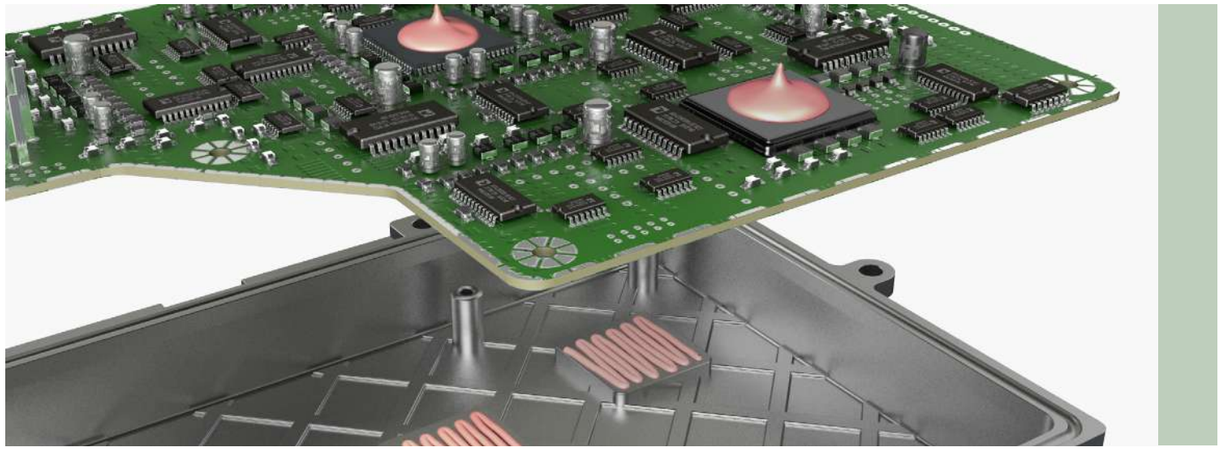
# POWER CONVERSION SYSTEMS



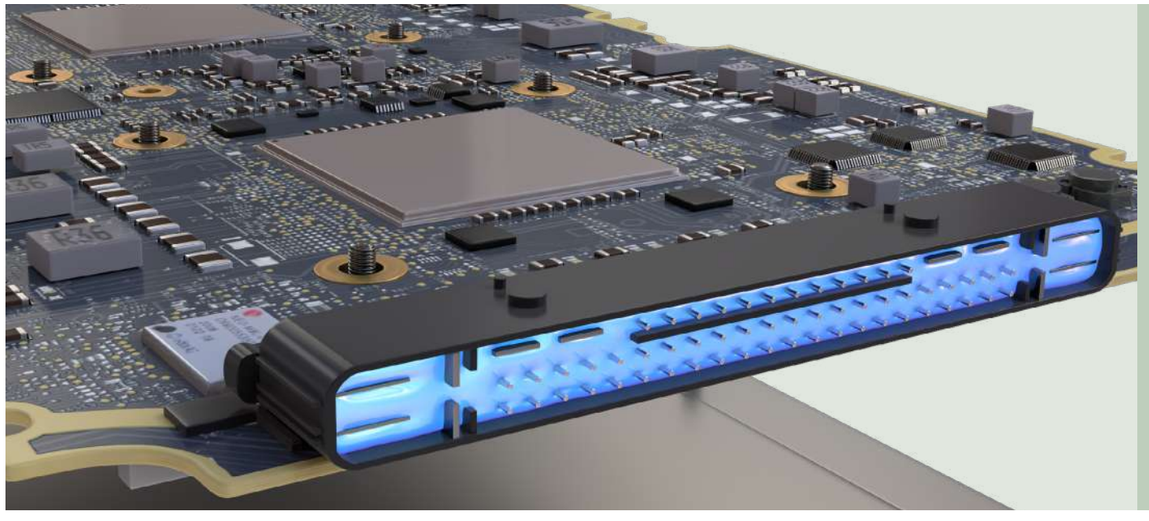
## GAP FILLERS

| 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. |
| BERGQUIST® TGF 1500 | Silicone | RT or heat | 1.8 W/mK | Low siloxane volatility, high temperature resistance. |
| BERGQUIST® TGF 2100LVO | Silicone | RT or heat | 2.2 W/mK | Low volatility silicone gap filler. |
| BERGQUIST® TGF 3500LVO | Silicone | RT or heat | 3.6 W/mK | Low Young's Modulus, high dielectric isolation. |
| BERGQUIST® TGF 3600 | 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. |
| BERGQUIST® TGF 4000LVO | Silicone | RT or Heat | 4.0 W/mK | Low volatility silicone gap filler. |
| BERGQUIST® TGF 4400LVO | Silicone | RT or Heat | 4.4 W/mK | Low volatility silicone gap filler. |

RT = Room temperature curing

## POTTING MATERIALS

| Product | Chemistry | Thermal conductivity | Viscosity (mixed) | Key properties |
|---|---|---|---|---|
| LOCTITE® SI 5631 | 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. |
| LOCTITE® EA 9496 | 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. |



DISCOVER OUR PORTFOLIO FOR

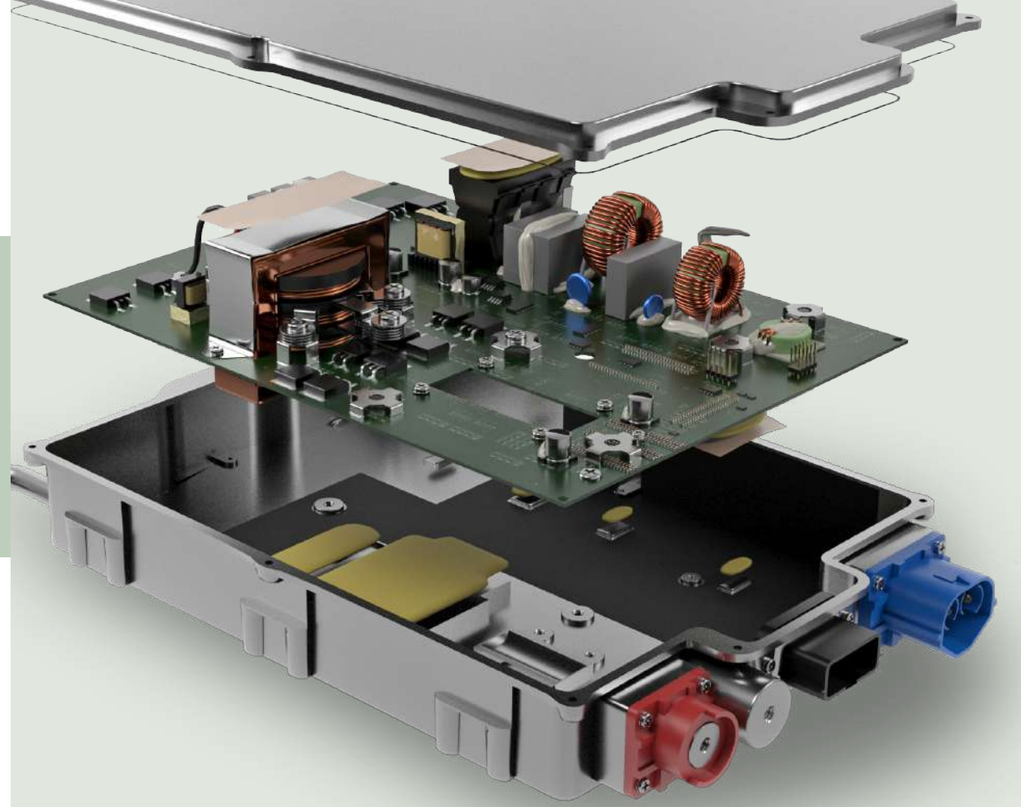
# POWER CONVERSION SYSTEMS

## GASKETING

| Product | Chemistry | Curing | Serviceability | Key properties |
|---|---|---|---|---|
| LOCTITE® SI 5970 | Silicone | RTV / FIPG | Yes* | High temperature stability, good moisture barrier, multi-substrate bonding. |
| LOCTITE® SI 5421 | Silicone | RTV / FIPG | Yes* | EMI gasketing, high temperature stability, good moisture barrier, multi-substrate bonding. |
| LOCTITE® AA 5884 | Polyacrylate | UV / CIPG | Yes | Quick cure, durable for heavy duty applications, compressible for good sealing capability, ATF and high temperature resistance, non-silicone. |
| BERGQUIST® TLB 400SLT | 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. |
| LOCTITE® AA 5820 | Polyacrylate | RTV / FIPG | Yes* | Durable for heavy duty applications, ATF and high temperature resistance, compatible with BERGQUIST® GAP FILLER. |
| LOCTITE® SI 5039 | 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





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 1000V0US** 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.

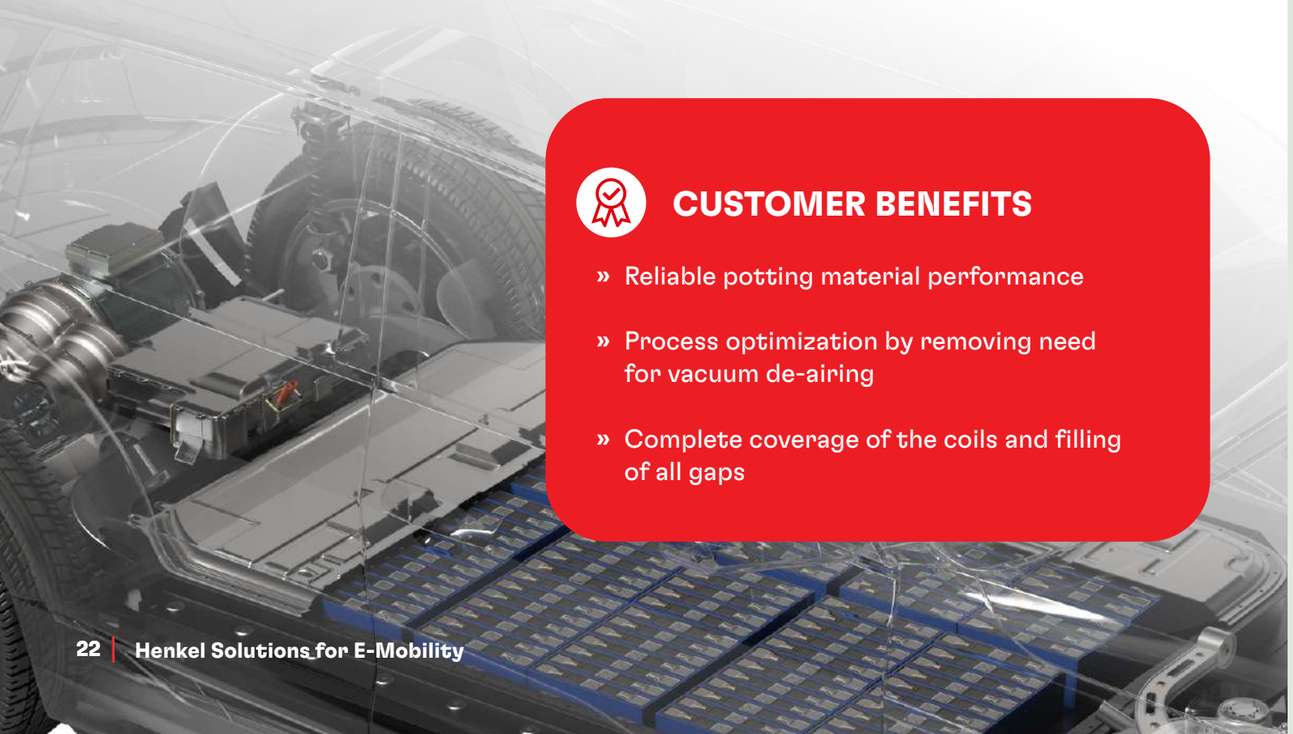
» **LOCTITE® SI 5970** was recommended for sealing the inverter, as it is approved by multiple OEMs and Tier 1 Suppliers for its compatibility with other chemistries of gap filler and potting compounds.

## 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



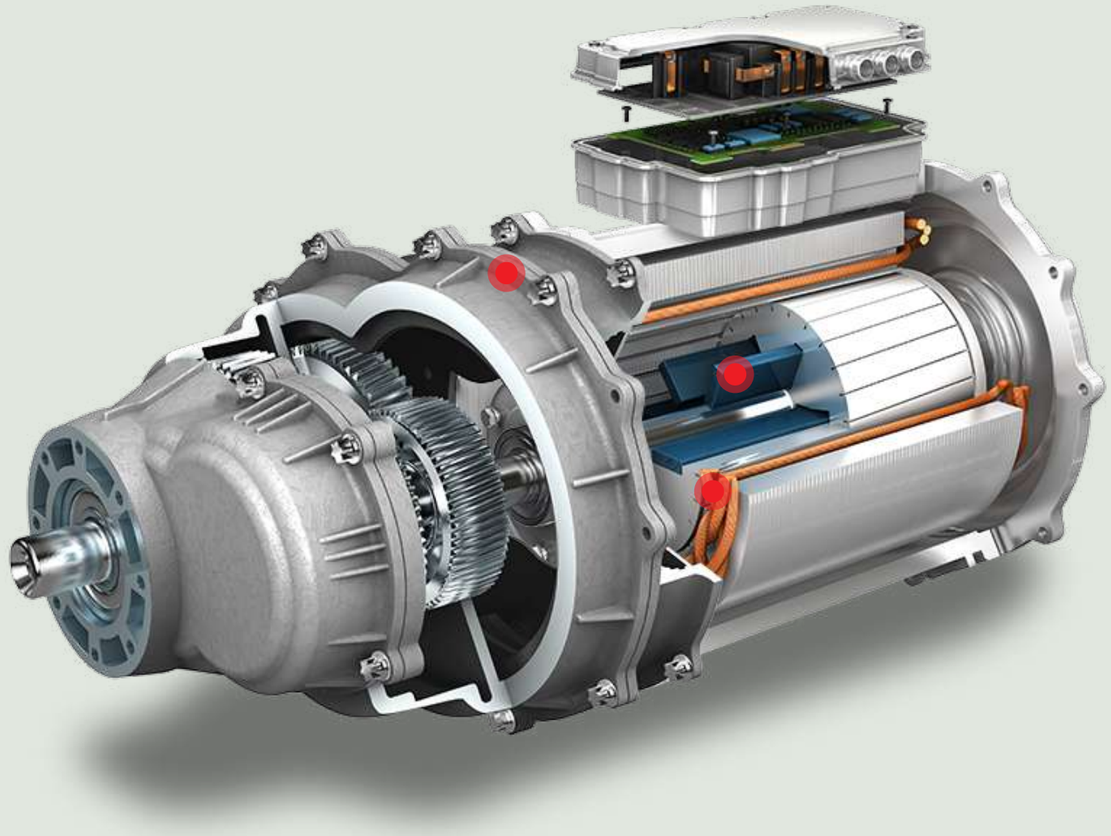
HENKEL SOLUTIONS FOR

# E-DRIVE SYSTEMS

**24** **GASKETING**
E-Drive housing/ ECU housing

**25** **THERMAL POTTING**
Induction coil

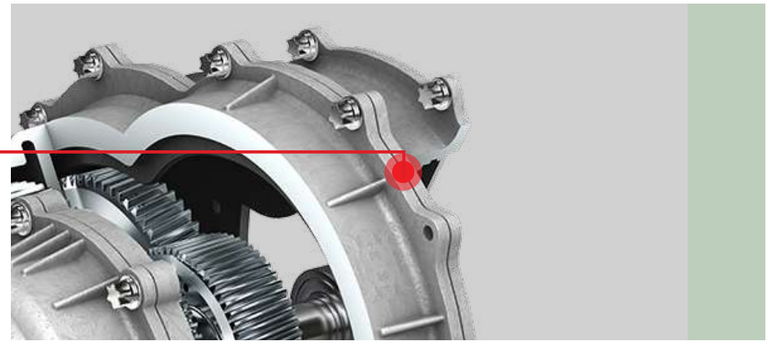
**25** **MAGNET BONDING**
Magnet to stator



DISCOVER OUR PORTFOLIO FOR

# E-DRIVE SYSTEMS

GASKETING



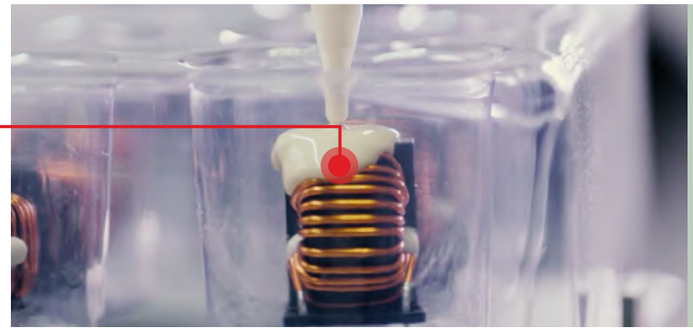
## GASKETING

| 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. |
| LOCTITE® AA 5884 | Polyacrylate | UV / CIPG | Yes | 30 sec at 270 mW/cm² | 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. |
| BERGQUIST® TLB 400SLT | 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. |

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



THERMAL POTTING

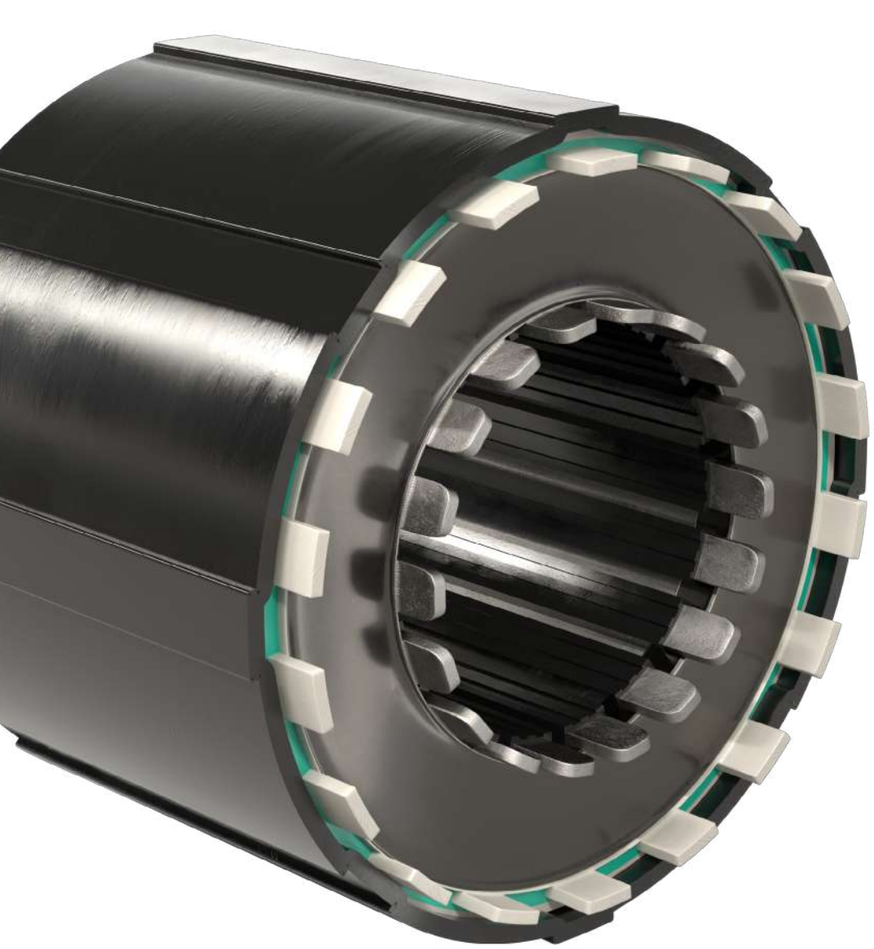


## POTTING MATERIAL

| Product | Chemistry | Thermal value | Viscosity (mixed) | Key properties |
|---|---|---|---|---|
| LOCTITE® SI 5643 | Silicone | 1.5 W/mK | 5,500 mPa·s at 25 °C | Two-component, fast curing, low viscosity thermally conductive potting compound. |
| 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). |



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.

### 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.

### 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

DISCOVER HENKEL'S

# BATTERY ENGINEERING CENTERS

Accelerating battery design and development through combining **virtual modeling and simulation** with **real-life material application and full-scale battery testing and validation.**

DISCOVER HENKEL'S BATTERY APPLICATION CENTER

# DÜSSELDORF, GERMANY


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



## MATERIAL SOLUTIONS

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

## CHEMISTRIES

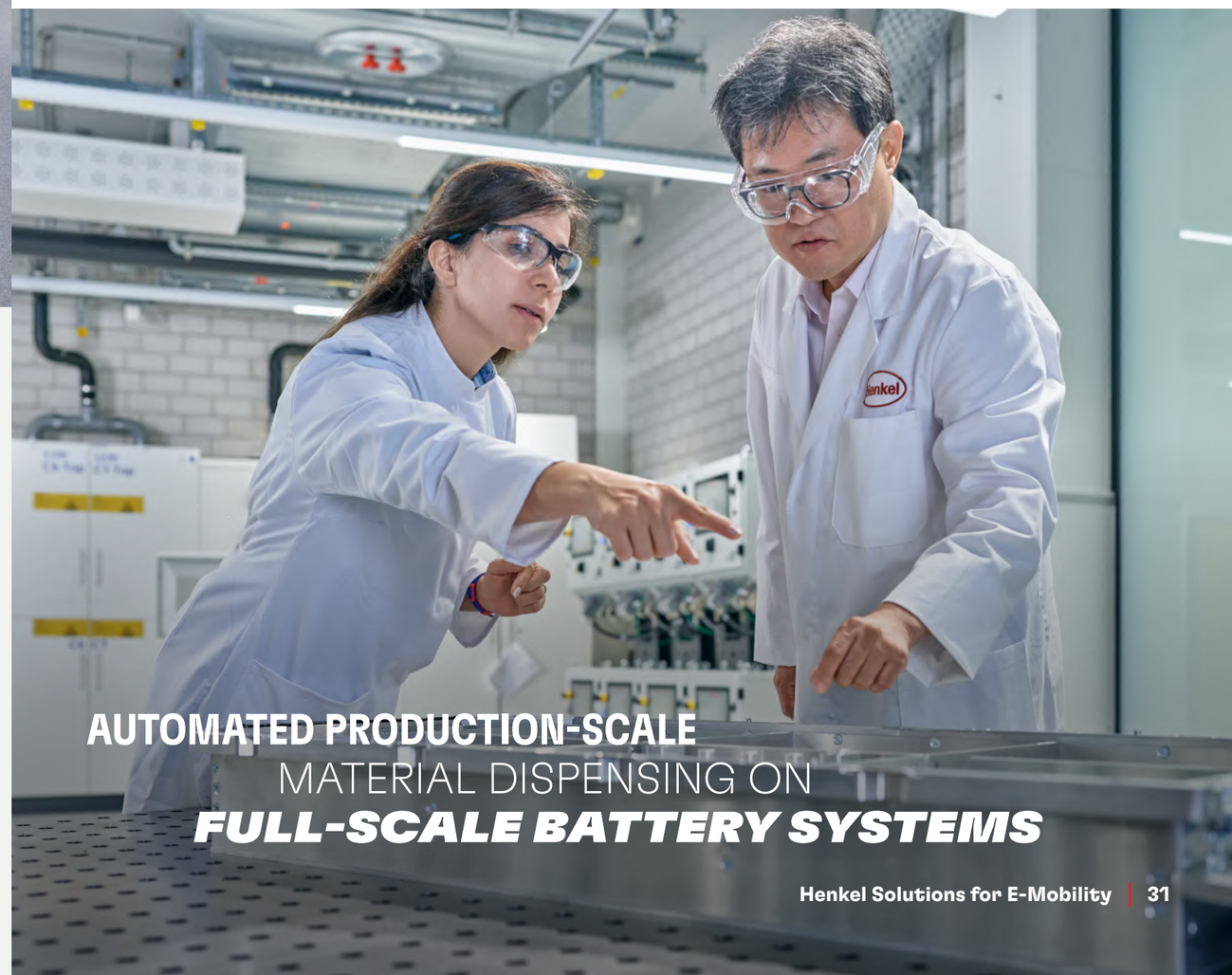
- PU
- Epoxy
- Silicone
- SMP/MS
- Acrylics
- Cold Butyls

## APPLICATIONS

- 1-component
- 2-component
- Flat stream

## CERTIFICATION

- Trusted Information Security Assesments Exchange (TISAX)



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

DISCOVER HENKEL'S BATTERY TEST CENTER

# DÜSSELDORF, GERMANY


## SIMULATION

- Digital twin of materials
- Material cards
- Structural & thermal performance

## CERTIFICATIONS

- Trusted Information Security Assessment Exchange (TISAX)

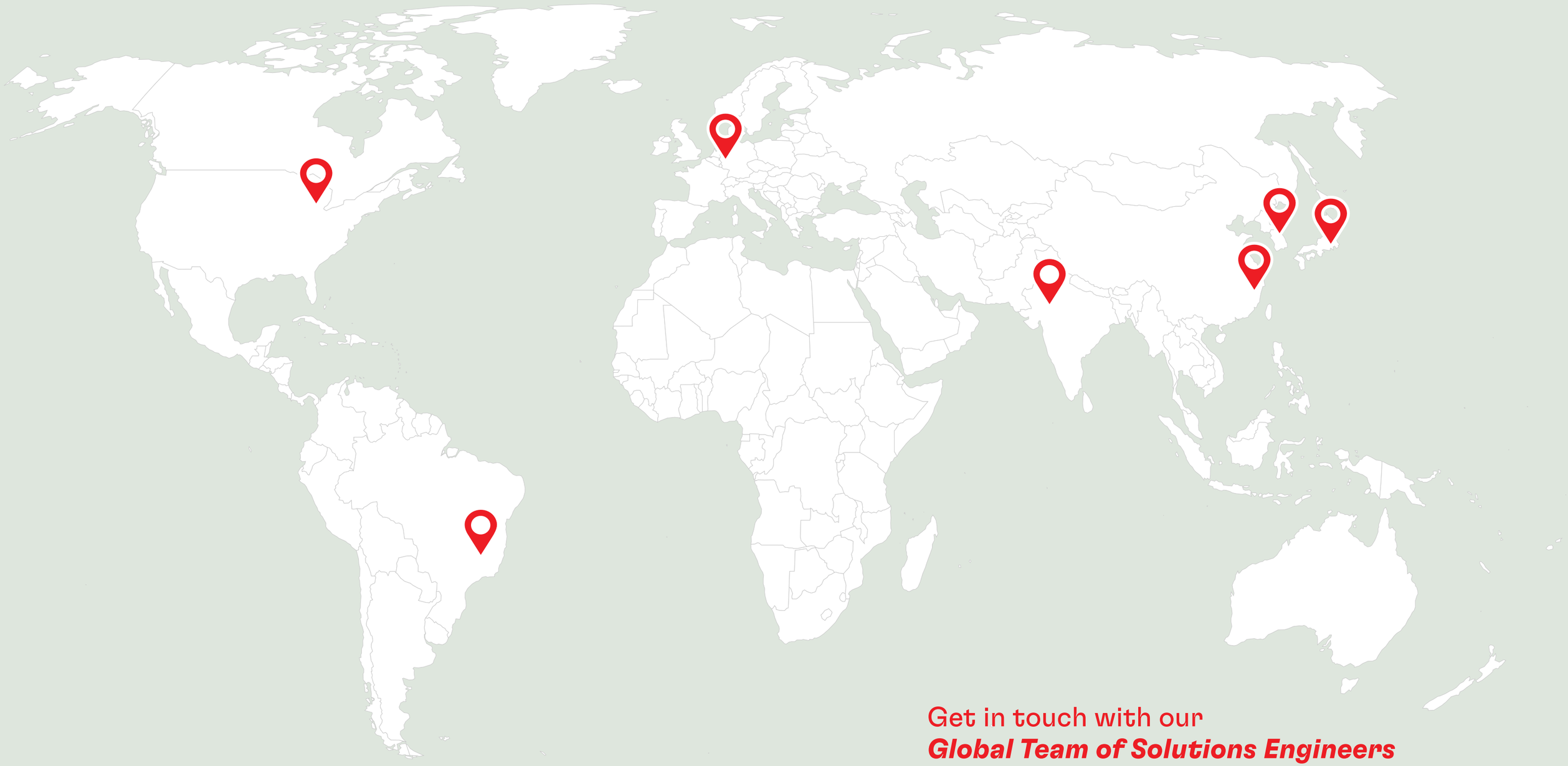
## TESTING

- Test rig with full end-of-line test capability
- Fast charging up to 330 kW 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

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

INNOVATION FOR

# ZERO-EMISSION MOBILITY



Get in touch with our
***Global Team of Solutions Engineers***

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BONDERITE®
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The data contained herein is intended as reference only. Some products/package sizes may not be available in your country or region or may have a lead time. Please contact your local Henkel subsidiary for assistance and recommendation on specifications and applications of these products.

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