



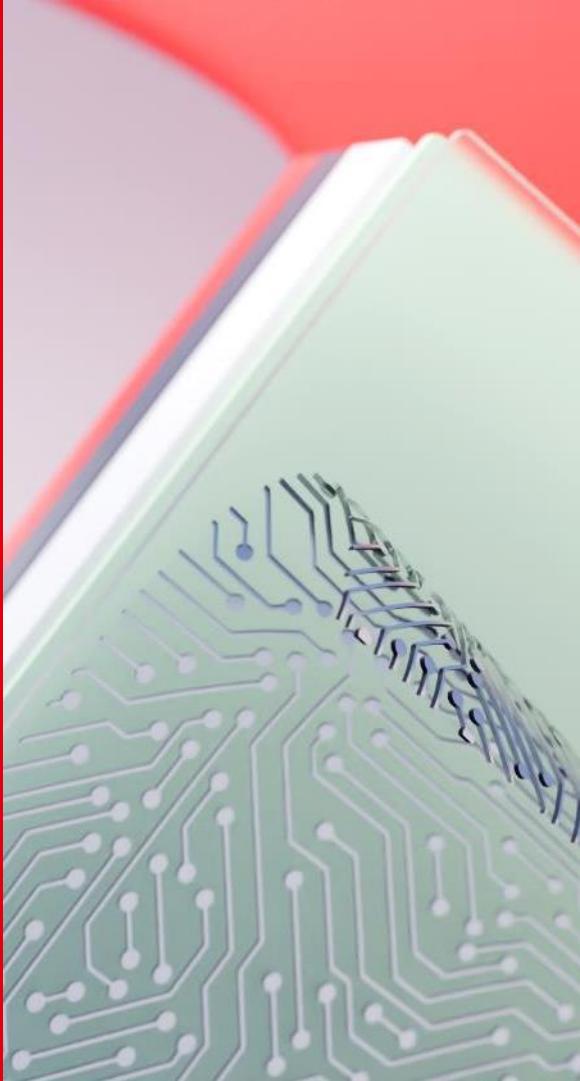
MATERIAL SOLUTIONS FOR
**ALTERNATIVE ENERGY
CONVERSION &
STORAGE**



AGENDA

01 **Introduction**

- 02 Application Overview
- 03 Thermal Management Solutions
- 04 Protecting Solutions
- 05 Bonding Solutions
- 06 Value of Henkel



INTRODUCTION

- Extracting power from alternative energy sources like the sun not only addresses the objective of sustainability but also significantly increases the amount and extends the availability of power to serve global needs, even in areas where there is limited infrastructure. Driving up the efficiency of a solar power network is key to harnessing as much energy from the source as possible.
- From the solar panel's DC output to the conversion in the inverter to the battery cell storage or grid, a solar energy system requires high-performance, dependable components to deliver power when and where required. Our advanced adhesive and thermal formulations protect outdoor electronics from environmental impacts, remove heat to raise performance efficiency and deliver on the long lifetime expectations of solar power systems.



MARKET NEEDS & TRENDS

Differentiators

SYSTEM COST

Fully automated production
Shortened cycle times
System design



SUSTAINABILITY

SVHC / CMR sensitive
Corporate citizenship
More with less



Design Targets

INCREASED POWER

Increased function
Increased communication
Faster charging / Increased range



SYSTEM INTEGRATION

Drive on motor
Power conversion



SMART SYSTEMS

Artificial intelligence
Security
Machine learning



MINIATURIZATION

Higher packaging density
Integration of electronics
WBG



EFFICIENCY

Better use of energy
Legislation
WBG



CONNECTIVITY

More data
Faster transmission
Energy <-> Internet



Must Haves

RELIABILITY

Thermal management
Environmental protection
Remote installations



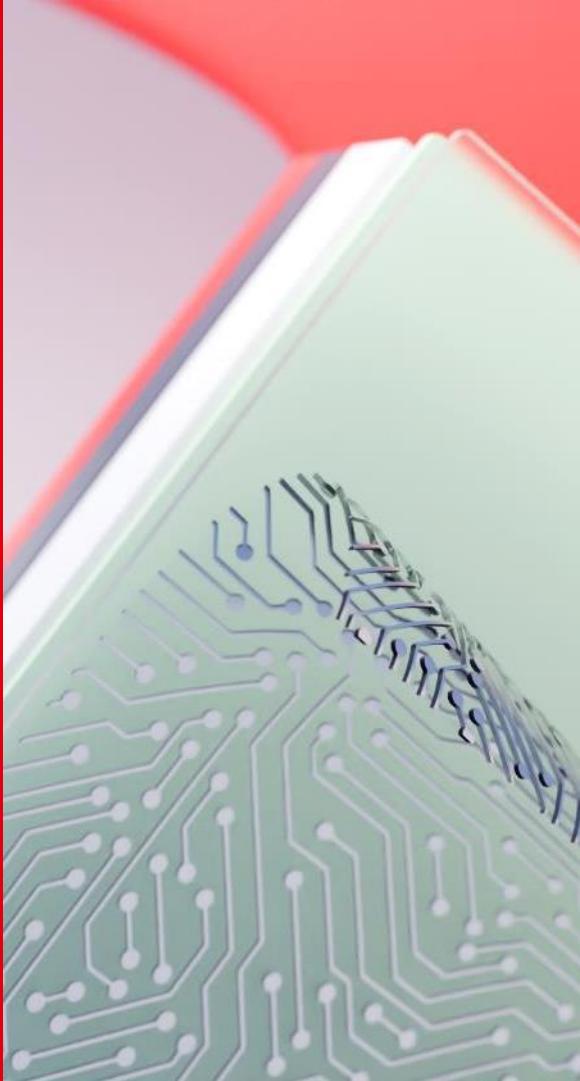
SAFETY

Environmental Protection
High voltage resistance
Flammability



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HENKEL MATERIAL SOLUTIONS

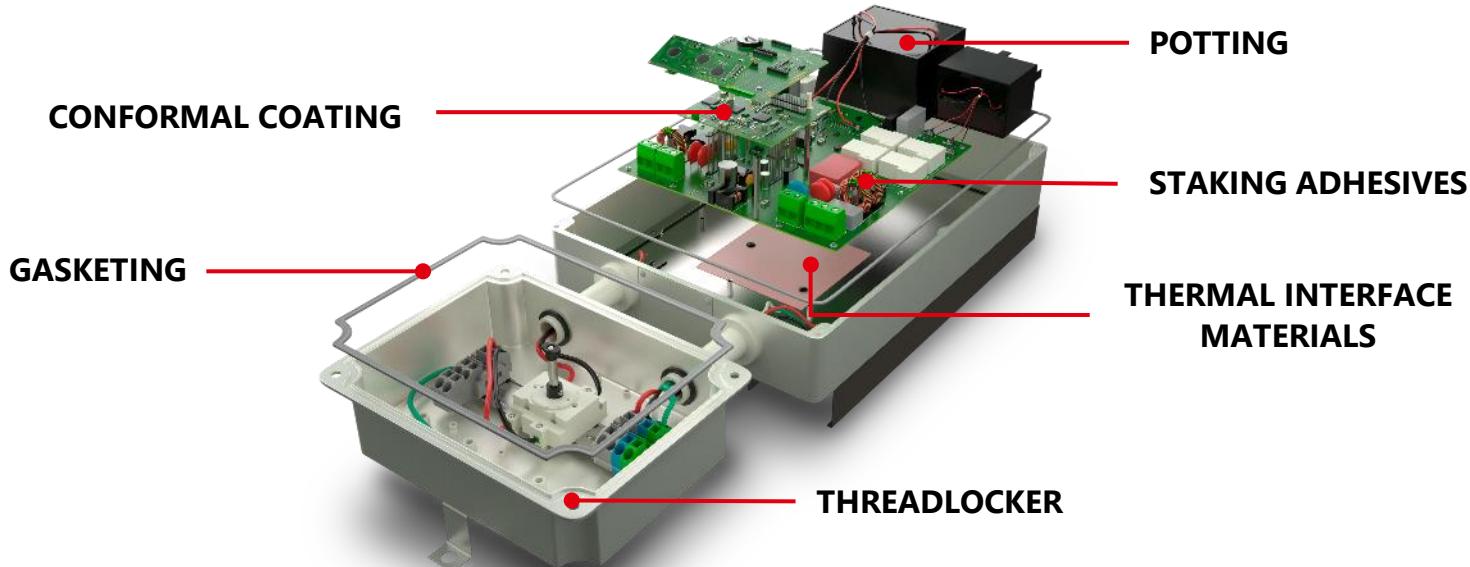
Overview

Application	Technology	Power Conversion	Energy Storage
Thermal	Thermally Conductive Insulating Films (Sil Pad, Hi Flow)	✓	
	Gap Filling Materials (GAP PAD, Gap Filler)	✓	✓
	Phase Change	✓	
	Thermally Conductive Adhesives		✓
Protecting	Potting	✓	
	Conformal Coating	✓	✓
	Gasketing / Sealing	✓	✓
Bonding	Thread Locking Adhesive	✓	
	Staking Adhesives	✓	
	Assembly and Structural Adhesives		✓



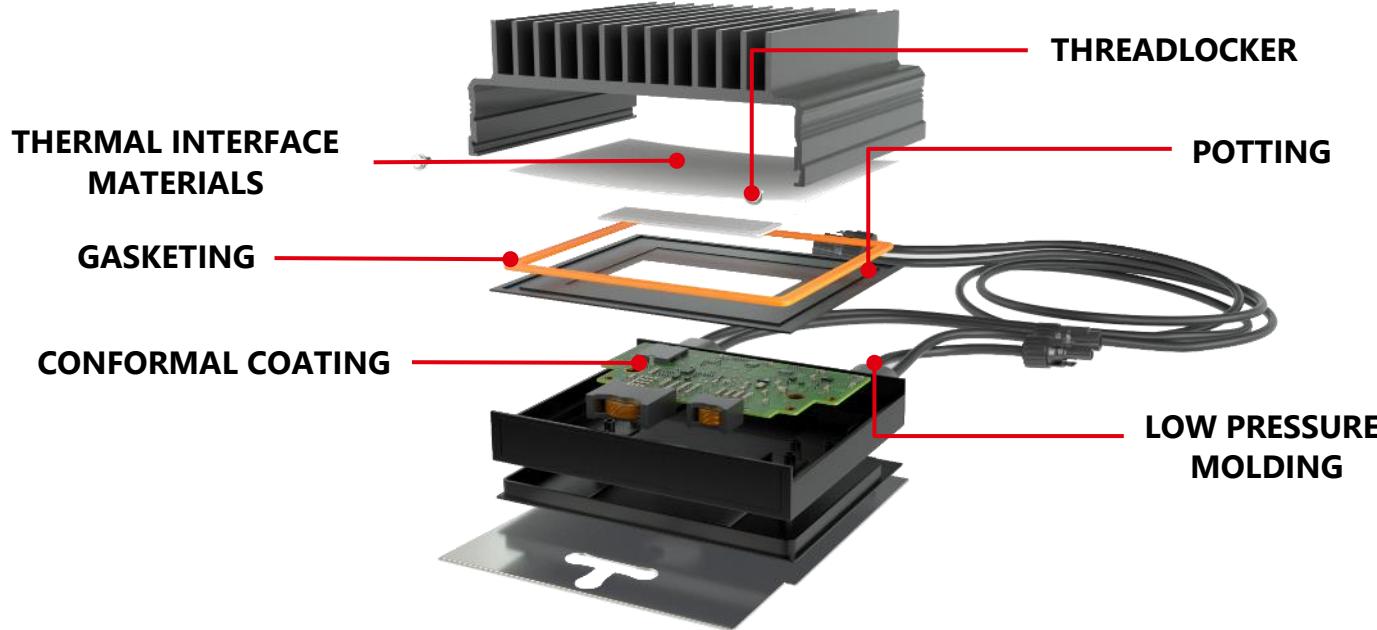
POWER CONVERSION SOLAR POWER INVERTERS

Material Solutions



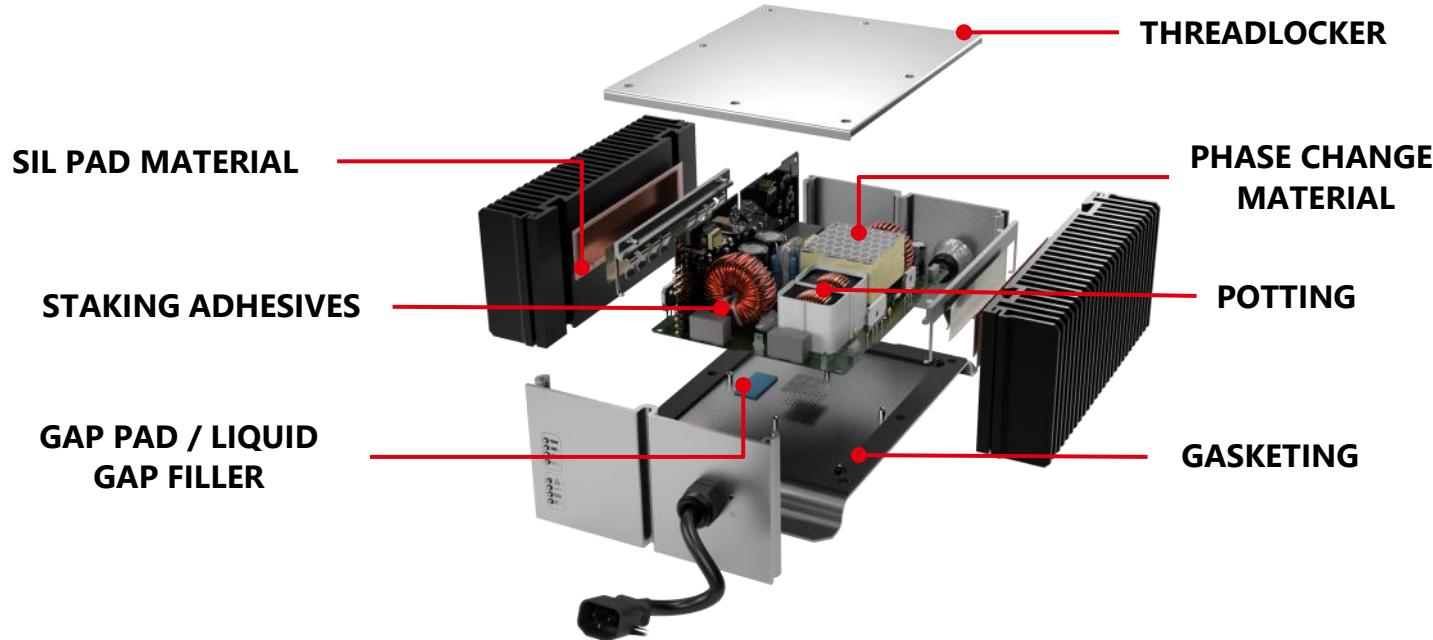
POWER CONVERSION SOLAR POWER OPTIMIZERS

Material Solutions



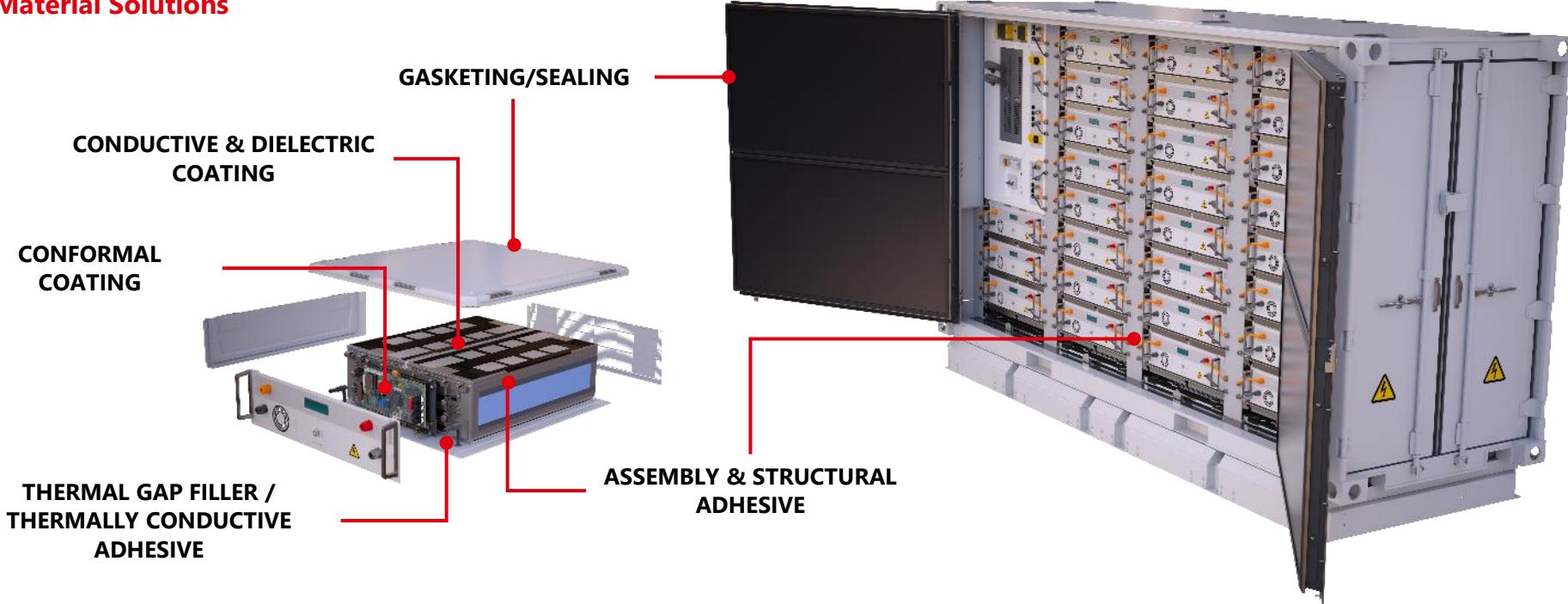
POWER CONVERSION INDUSTRIAL BATTERY CHARGERS

Material Solutions



BATTERY ENERGY STORAGE SYSTEMS (BESS) LITHIUM-ION BATTERIES

Material Solutions



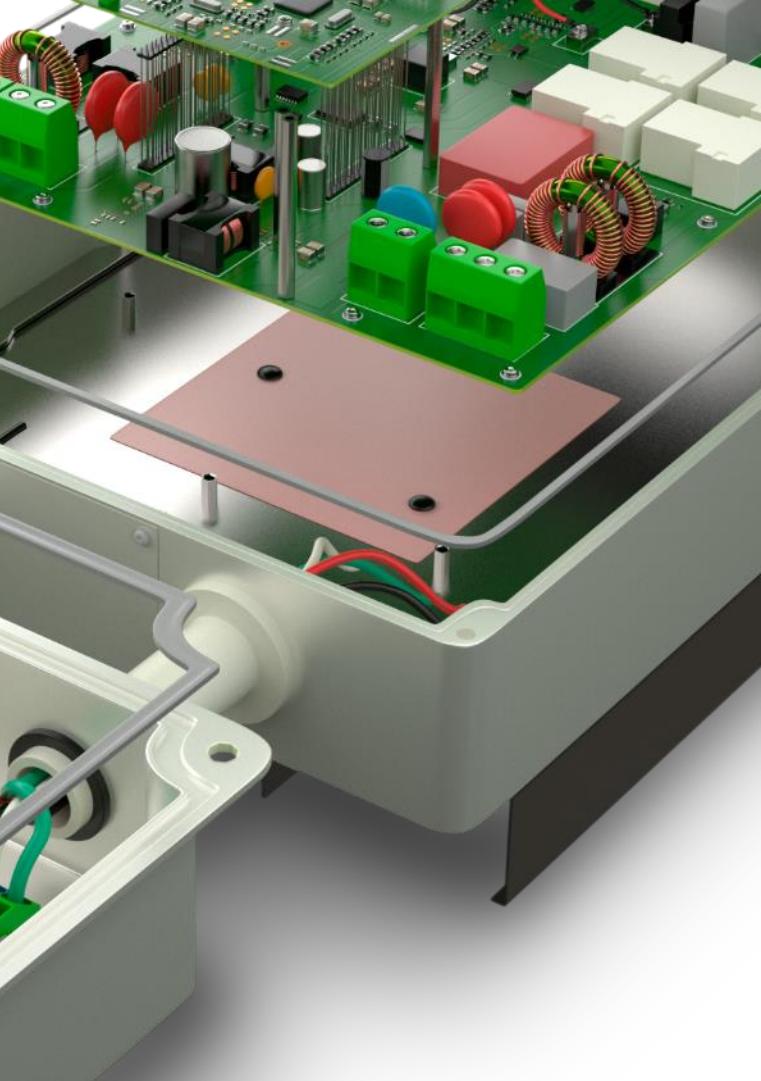
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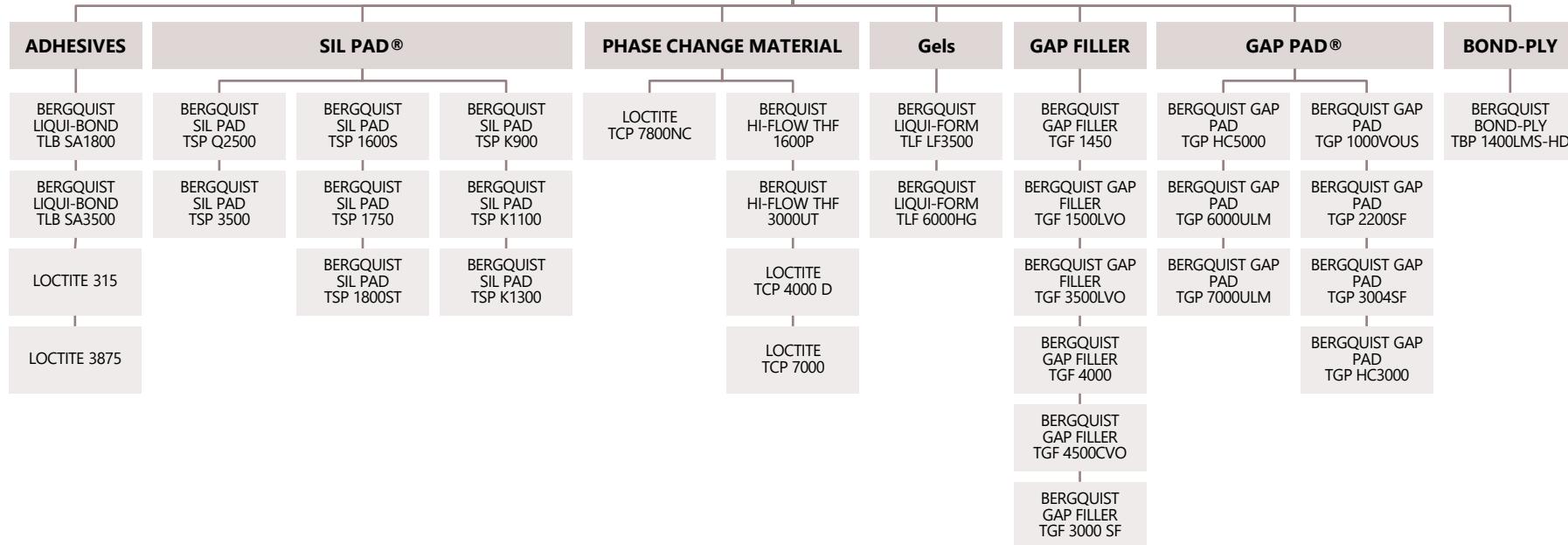
THERMAL MANAGEMENT

- Thermal Interface Materials (TIM) help dissipate heat from power switching components while providing safety agency recognized insulation.
- Provide a safe reliable product with proven pedigree to meet expected lifetimes in outdoor and unprotected environments.
- A broad portfolio of suitable products that can meet performance needs and process capabilities with a sensitivity to total cost of ownership.
- Thermal pads, insulators and phase change materials provide a wide range of thermal performance and insulation properties opening many power electronics packaging options.

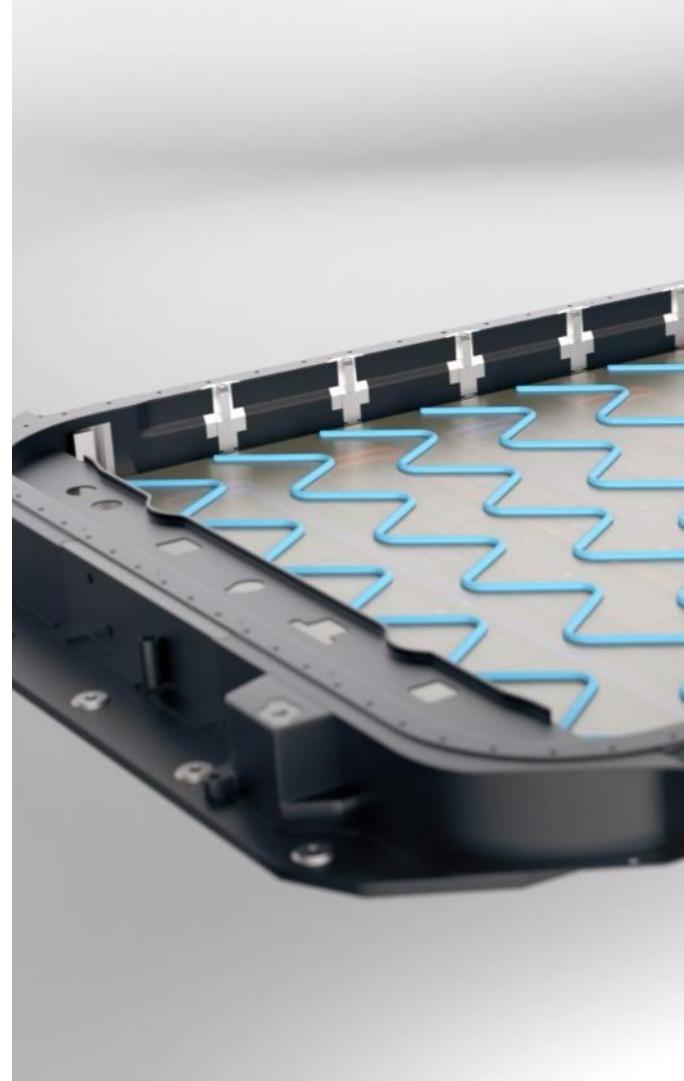
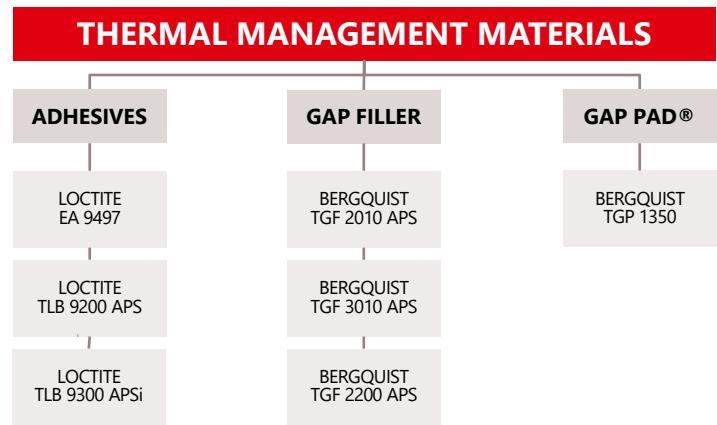


POWER CONVERSION THERMAL MANAGEMENT SOLUTIONS

THERMAL INTERFACE MATERIALS



ENERGY STORAGE THERMAL MANAGEMENT SOLUTIONS



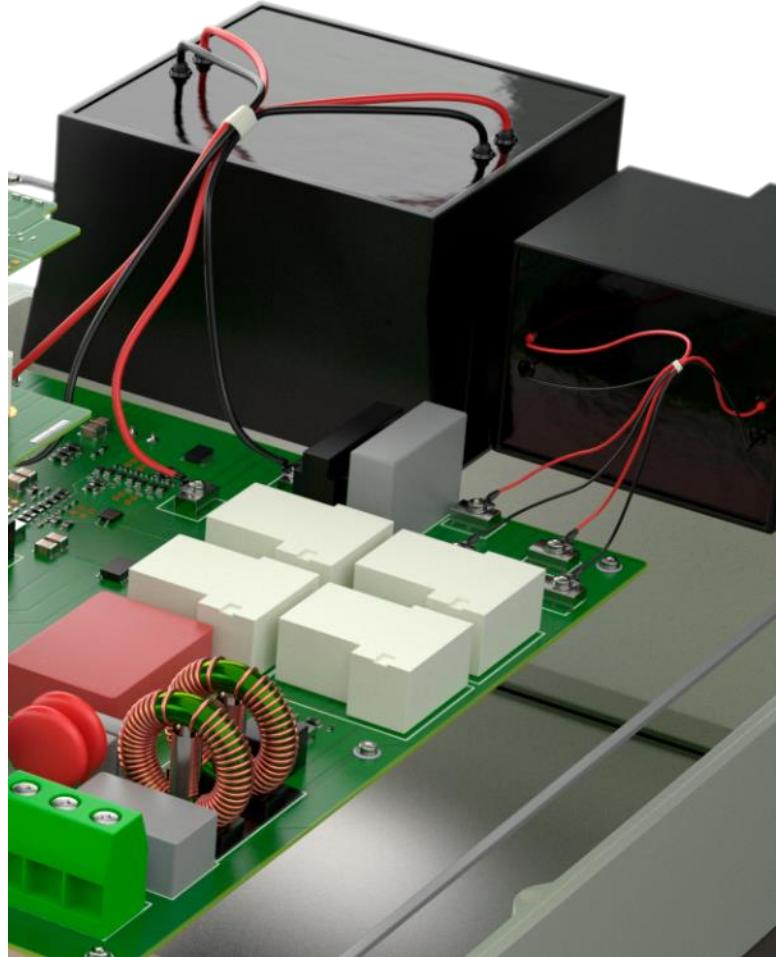
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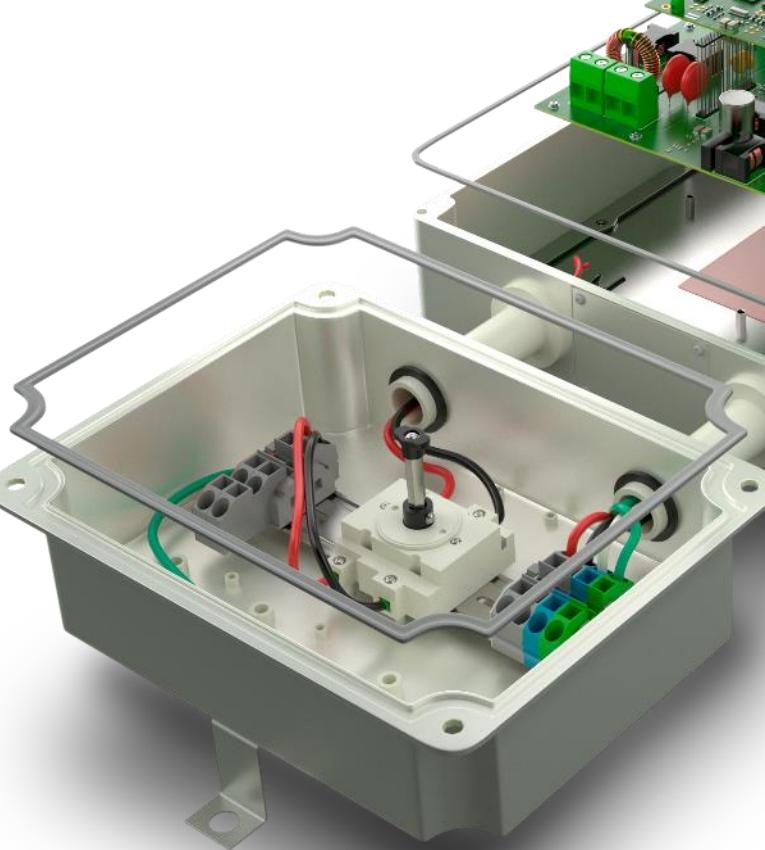
POTTING

- UL V-0 potting with fast curing and easy dispensing:
 - Multiple gel time options to fit process requirements
 - Room temperature cure or can be accelerated by heat
- Tough materials with high elongation to break that are stable over a wide range of temperature and humidity.
- Good adhesion to common molding plastics to provide a high degree of protection.
- Strong dielectric properties for safe high voltage operation.



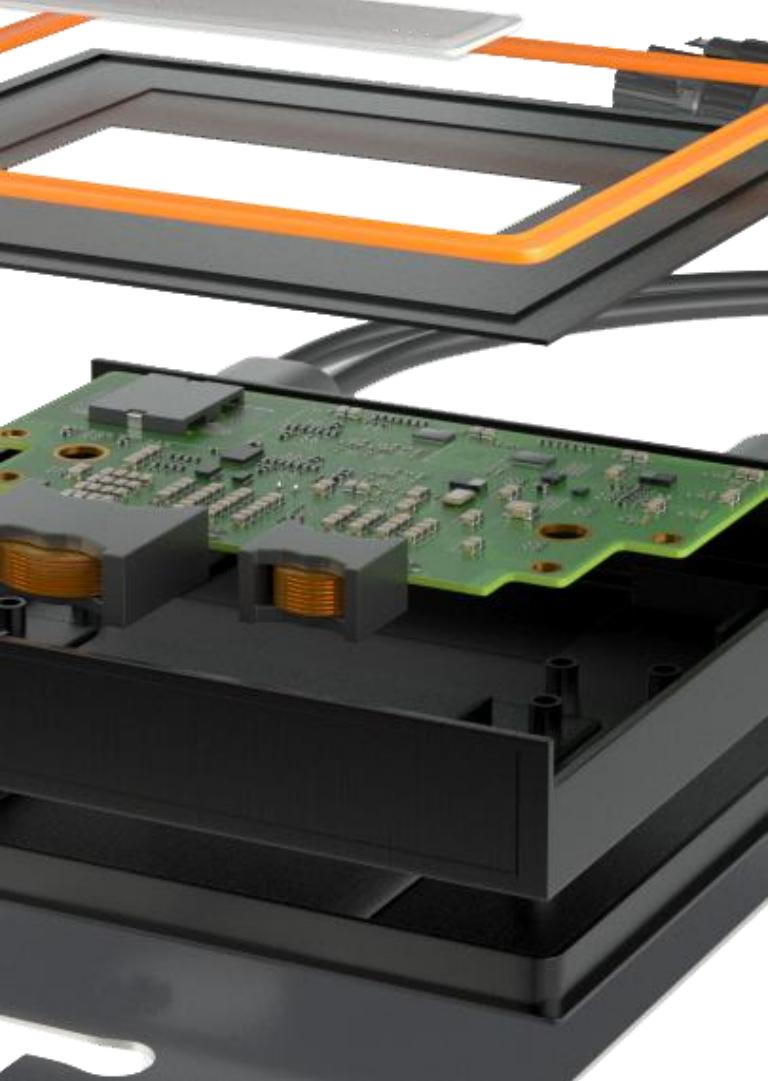
GASKETING/SEALING

- Proven sealing solution for electrical enclosures and automotive applications.
- Automated to provide cost effective, repeatable deposition of gasket for high volume applications:
 - Deposition can be easily modified for different enclosure geometry for different charger types
 - Cures at room temperature or can be accelerated with heat.
- In situ foaming and curing in place to remove seams.
- Provides good adhesion to powder coated and plastic housings.
- NEMA certified solutions.
- Applicable for environments:
 - PU based solutions from -40C to 80C
 - PDMS based solutions extended from -55C to 150C.



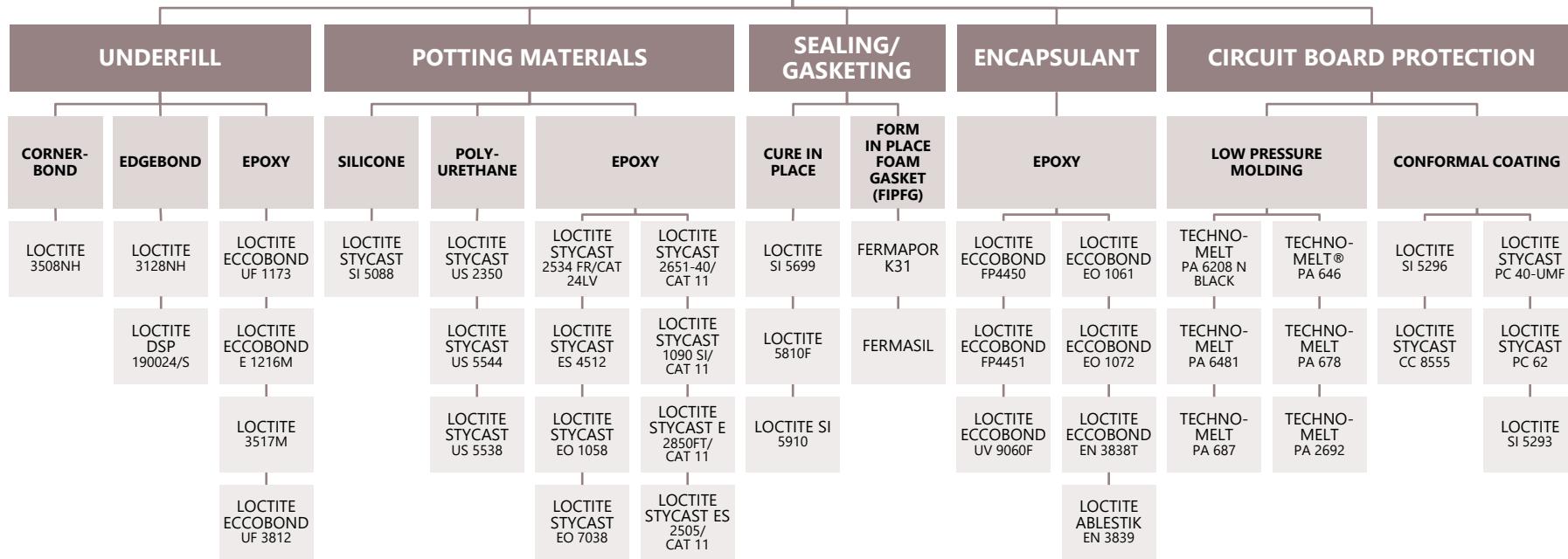
CONFORMAL COATING

- Conformal coating materials protect PCBs and advanced substrates from thermal shock, moisture, corrosive liquids and other adverse environmental conditions, ensuring long product life cycles.
- With exceptionally fast cure capability and wide processing windows, Henkel's conformal coatings provide fast processing and high yields.
- Solventless, SVHC and Tin-free formulations with UL and moisture cure capability provide a sustainable advantage.

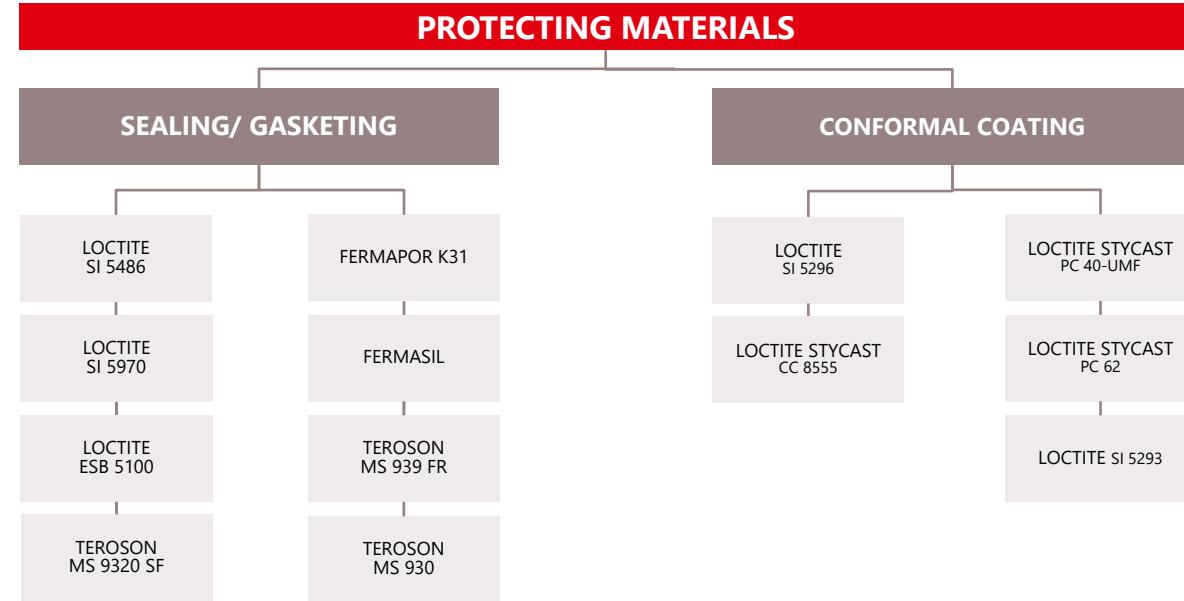


POWER CONVERSION PROTECTING SOLUTIONS

PROTECTING MATERIALS



ENERGY STORAGE PROTECTING SOLUTIONS



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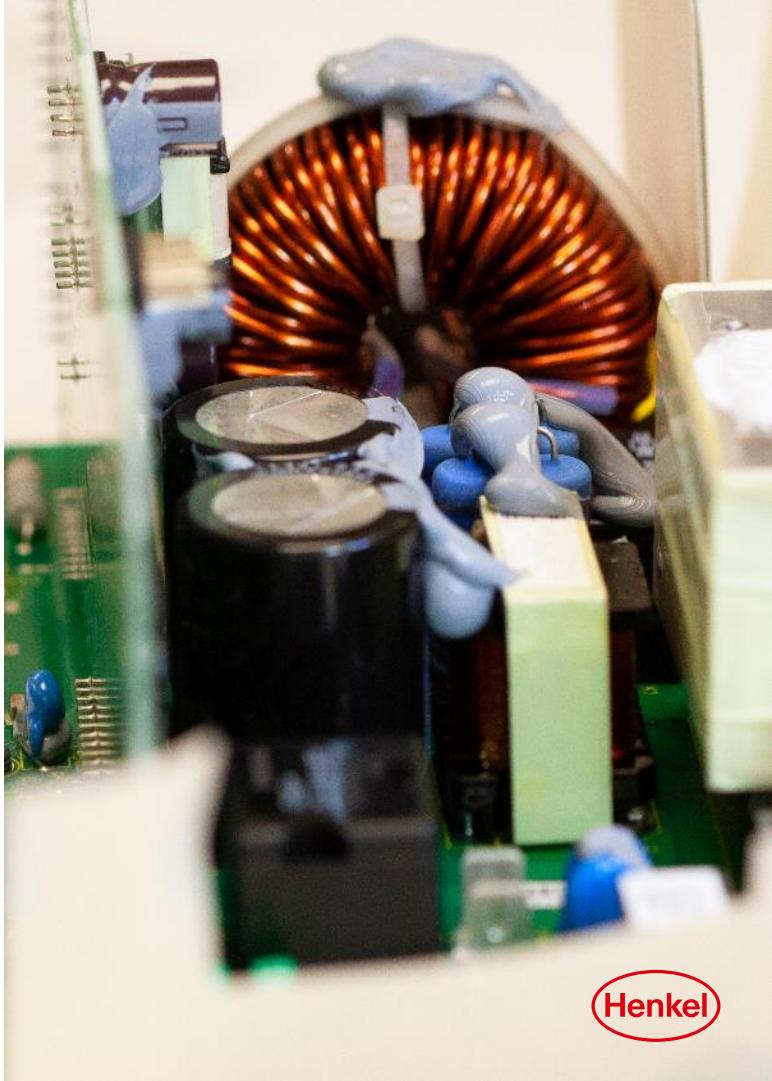
THREADLOCKERS

- Threadlockers will reliably lock, and seal threaded fasteners.
- Liquid threadlockers also provide reliable disassembly – you can take it apart when needed.
- Key benefits include:
 - Locks mating threads to prevent loosening from vibration & shock
 - Seals against fluids & corrosion
 - Provides lubricity to achieve controlled strength during assembly
 - Prevents galling and seizing for reliable disassembly.



STAKING ADHESIVES

- Designed for bonding and enhancing mechanical and structural stability, staking adhesives offer resistance to multiple fluids, salts, acids and alkalis.
- Epoxy-based, solvent-free, low-outgassing and non-conductive, staking materials have adhesion compatibility with a wide range of materials for enhanced physical strength and reliability.



ASSEMBLY AND STRUCTURAL ADHESIVES

- Assembly adhesives are used to mount battery cells with good adhesion and high bonding strength.
- Structural adhesives for energy storage applications are challenged with high requirements regarding a structural, primerless bonding at a high production speed.



POWER CONVERSION BONDING SOLUTIONS

BONDING MATERIALS

THREADLOCKER	DIE ATTACH ADHESIVES		CHIPBONDER	ASSEMBLY ADHESIVES	
ACRYLIC	EPOXY		EPOXY	EPOXY	ACRYLIC
LOCTITE 243	LOCTITE ABLESTIK ABP 8068TB	LOCTITE ABLESTIK 84-3	LOCTITE 3609	LOCTITE ABLESTIK 2151	LOCTITE® AA 3103
LOCTITE 248	LOCTITE ABLESTIK SP 2020	LOCTITE ABLESTIK 8700K	LOCTITE 3616	LOCTITE ABLESTIK 2332	
	LOCTITE ABLESTIK QMI529HT	LOCTITE ABLESTIK 8900NC	LOCTITE 3627	LOCTITE ABLESTIK 3128	
	LOCTITE ABLESTIK QMI529HT-LV	LOCTITE ABLESTIK ABP 8064T		LOCTITE ABLESTIK G 500	

ENERGY STORAGE BONDING SOLUTIONS

BONDING MATERIALS

BATTERY ASSEMBLY & STRUCTURAL ADHESIVES

TEROSON MS 9399

TEROSON EP 5065

LOCTITE AA 3525

TEROSON PU 6700ME/6800

LOCTITE AA 3963

TECHNOMELT PS 1573E

LOCTITE AA H8000

LOCTITE UK 2015

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VALUE OF HENKEL

Power Conversion & Industrial Automation



FORMULATED for
Continuous Performance
and Sustainable Results

Henkel materials are driving value for the Power Conversion & Industrial Automation market through high-performance formulas that secure steady operation with effective thermal management, durable adhesion, efficient protection, reliable electrical function and long-term sustainability.

VALUE OF HENKEL

ADHESIVE TECHNOLOGIES

Products

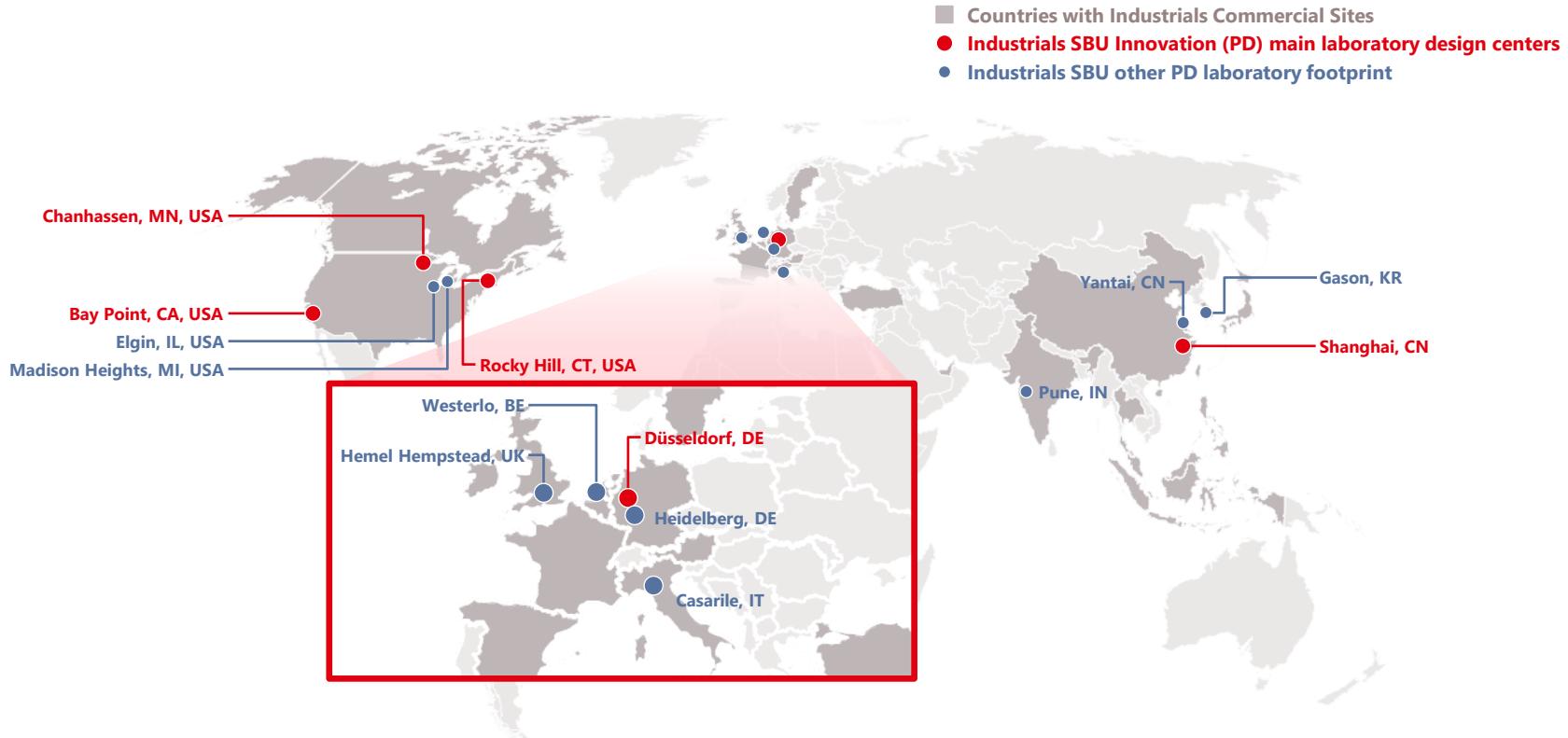
- **Thermal products** from Henkel's **BERGQUIST** brand are proven in demanding applications and help increase **power density**, improve **reliability**, and reduce overall **cost of ownership**
- Henkel's potting solutions provide **protection** from environmental conditions that can damage sensitive electrical components while maintaining a low modulus to **minimize stress** on components.
- **LOCTITE** conformal coating materials **safeguard** printed circuit boards against harsh environments, ensuring **reliable**, long-term operation. Henkel's conformal coatings enable **high-throughput**, **environmentally-responsible** manufacturing.
- **LOCTITE** industrial adhesives are designed to aid in the manufacture of components and materials. These innovative industrial adhesive products are formulated to withstand severe impact and peel forces, provide high sheer strength, and offer excellent chemical and temperature resistance.
- With **Henkel**, manufacturers can rely upon **high performance** electronic adhesives from recognized brands with a proven track record of **reliability** under harsh operating conditions and reducing total **cost of ownership** for our customers.
- Our focus on **safe** and **environmentally socially responsible** materials ensure that our customers can meet any legal requirements as well as the highest ideals of **corporate citizenship**.



LOCTITE®
TECHNOMELT®
BERGQUIST

 sonderhoff

OUR GLOBAL FOOTPRINT



VALUE OF HENKEL



VALUE OF HENKEL

	Innovation	Collaboration at the design phase ensures product development initiatives hit the mark. Teams of materials scientists, broad global lab resources and advanced development capabilities secure innovation delivery.
	Product and Process Performance	Holistic understanding of systems design and compatible material platforms mitigate risk, raise performance and enhance reliability.
	Quality	A commitment to operational excellence and assurance of strict safety standards are foundational for quality outcomes and end user satisfaction.
	Global Capability	Personnel, R&D and manufacturing footprints in every region globally provide agility, well-resourced technical support and on-the-ground solutions.
	Sustainability	Embrace sustainability as a value driver through differentiated, high impact solutions that enable a low-carbon circular economy, driving efficiency and facilitating growth.
	Optimized Total Cost of Ownership	Cost reductions are achieved via streamlined production, material reliability, automation equipment solutions, access to technical expertise and manufacture of the highest-quality, durable end products.

THANK YOU.



FIND OUT MORE - SOLUTIONS FOR ALTERNATIVE ENERGY CONVERSION AND STORAGE