LOCTITE®
TECHNOMELT®

BERGQUIST®

HENKEL ELECTRONIC MATERIAL SOLUTIONS FOR

RADAR, GUIDANCE SYSTEM, AND AVIATION INDUSTRIES

Henkel

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INTRODUCTION

Henkel has more than 40 years of experience supplying quality adhesives for high reliability applications designed for aircraft, unmanned aerial vehicles (UAV), ground and maritime vehicles, satellites, guidance systems, radar, sonar and homeland security with LOCTITE®, TECHNOMELT® and *BERGQUIST* product solutions. We are qualified and specified by all major aerospace OEMs and contractors, supporting our products through a worldwide sales, applications engineering, research and development and manufacturing network.

Our state-of-the-art products, certification to major aerospace specifications, and technical expertise ensure that products built with Henkel electronic assembly materials will be the highest in performance and in reliability. We are committed to meeting and exceeding your requirements with:

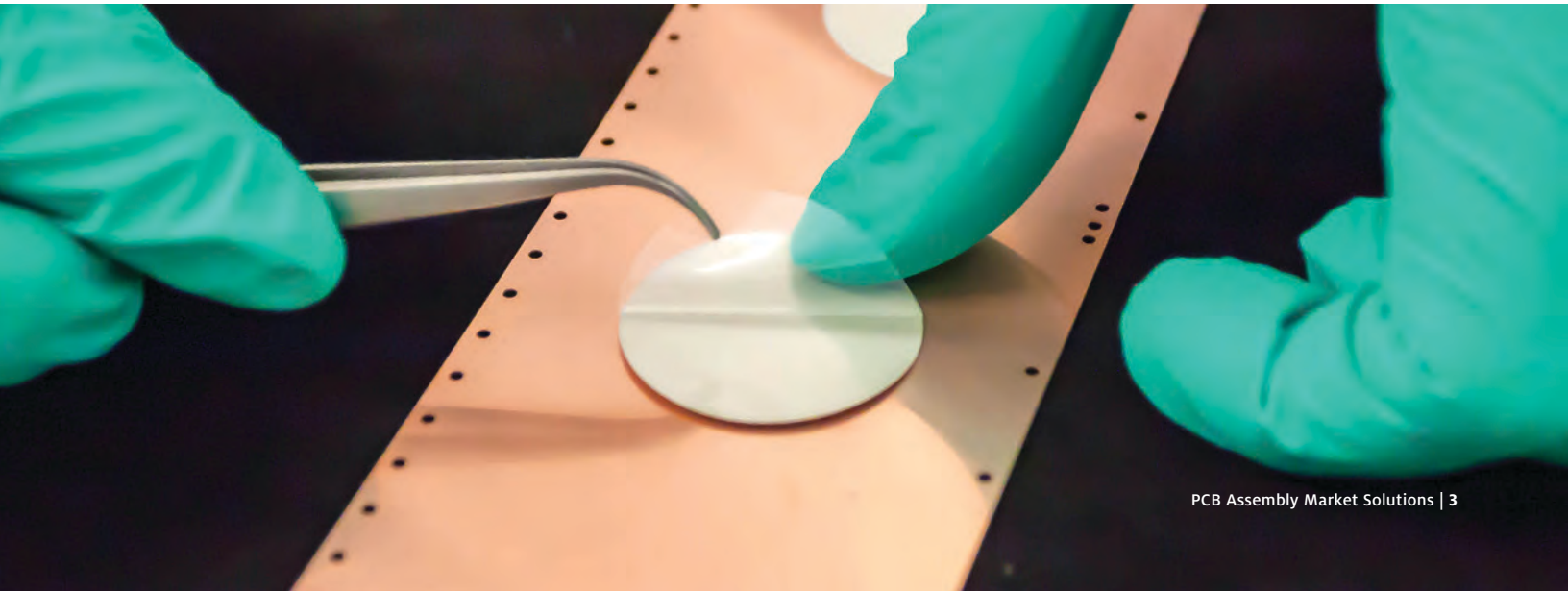
- NASA outgassing ASTM E 595-77/84/90 approved products
- Proven film and paste technology in aerospace applications
- Custom film pre-form manufacturing capability
- Low-risk supply chain

PCB ASSEMBLY MARKET SOLUTIONS

PRODUCT PORTFOLIO

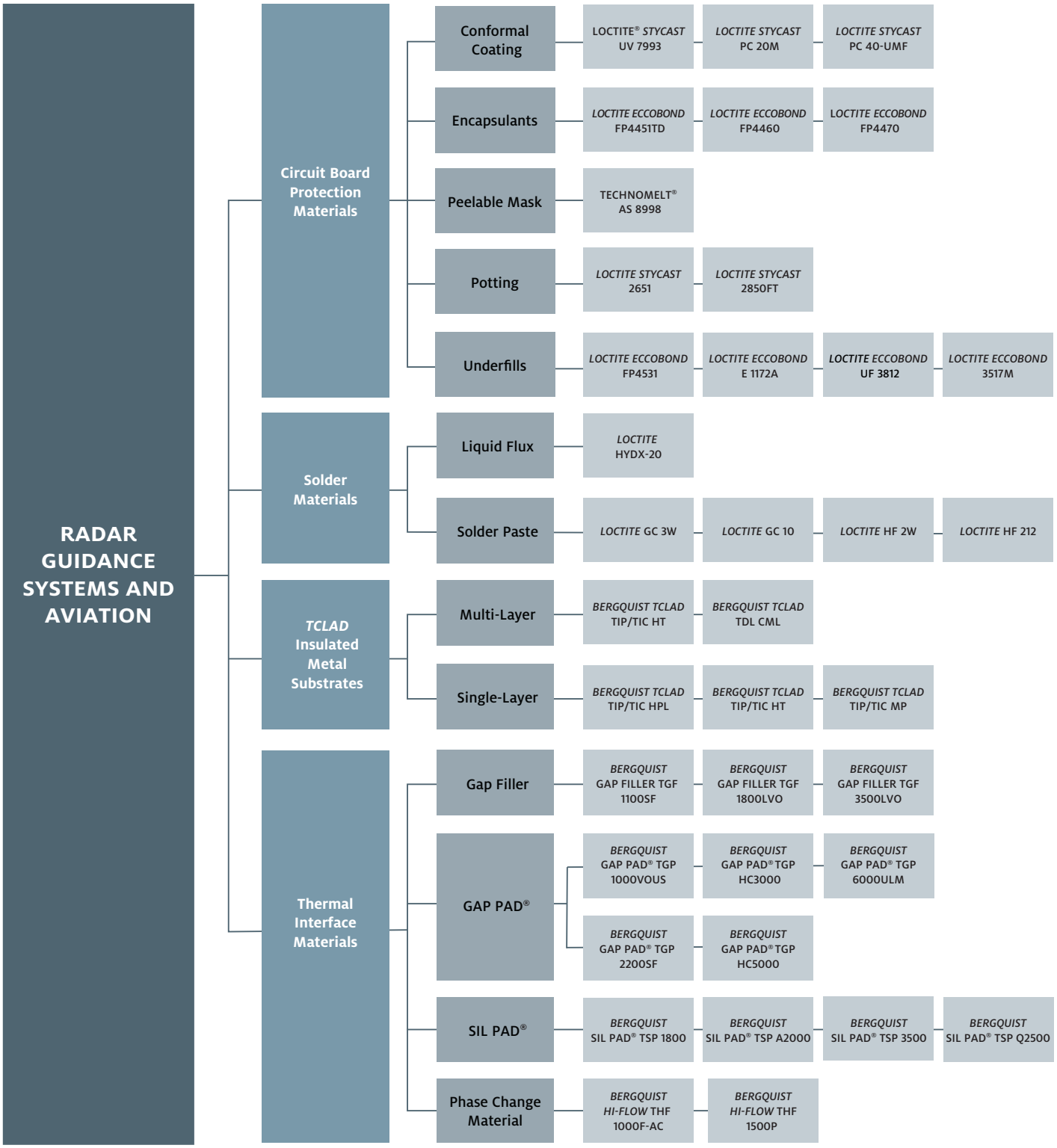
RADAR GUIDANCE SYSTEMS AND AVIATION

- **Paste Adhesives**
  - Electrically Conductive
    - LOCTITE® ABLESTIK 84-1LMIT1
    - LOCTITE ABLESTIK 967-1
    - LOCTITE ABLESTIK 8700E
    - LOCTITE ABLESTIK 85-1
    - LOCTITE ABLESTIK 56C
    - LOCTITE ABLESTIK QMI529HT-LV
    - LOCTITE ABLESTIK CE 3104WXL
    - LOCTITE ABLESTIK 57C A/B
    - LOCTITE ABLESTIK CE 8500
    - LOCTITE ABLESTIK 3880
    - LOCTITE ABLESTIK 2902
    - LOCTITE ABLESTIK CE 3103WLV
    - LOCTITE ABLESTIK 8175
  - Electrically Insulating
    - LOCTITE ABLESTIK 84-3
    - LOCTITE ABLESTIK 958-11
    - LOCTITE ABLESTIK 8700K
    - LOCTITE ABLESTIK 104 A/B
    - LOCTITE ABLESTIK 724-14C
    - LOCTITE ABLESTIK 2151
- **Film Adhesives**
  - Electrically Conductive
    - LOCTITE ABLESTIK 5025E
    - LOCTITE ABLESTIK CF 3350
    - LOCTITE ABLESTIK CF 3366
    - LOCTITE ABLESTIK CF 3352
    - LOCTITE ABLESTIK ECF 561E
    - LOCTITE ABLESTIK ECF 563
    - LOCTITE ABLESTIK ECF 564A
    - LOCTITE ABLESTIK ECF 564AHF
  - Electrically Insulating and Thermally Conductive
    - LOCTITE ABLESTIK 550K
    - LOCTITE ABLESTIK 561K
    - BERGQUIST BOND-PLY TBP 800-1
    - LOCTITE ABLESTIK 563K
    - LOCTITE ABLESTIK 5020K
    - BERGQUIST BOND-PLY TBP 1400LMS-HD



PCB ASSEMBLY MARKET SOLUTIONS – CONT.

PRODUCT PORTFOLIO



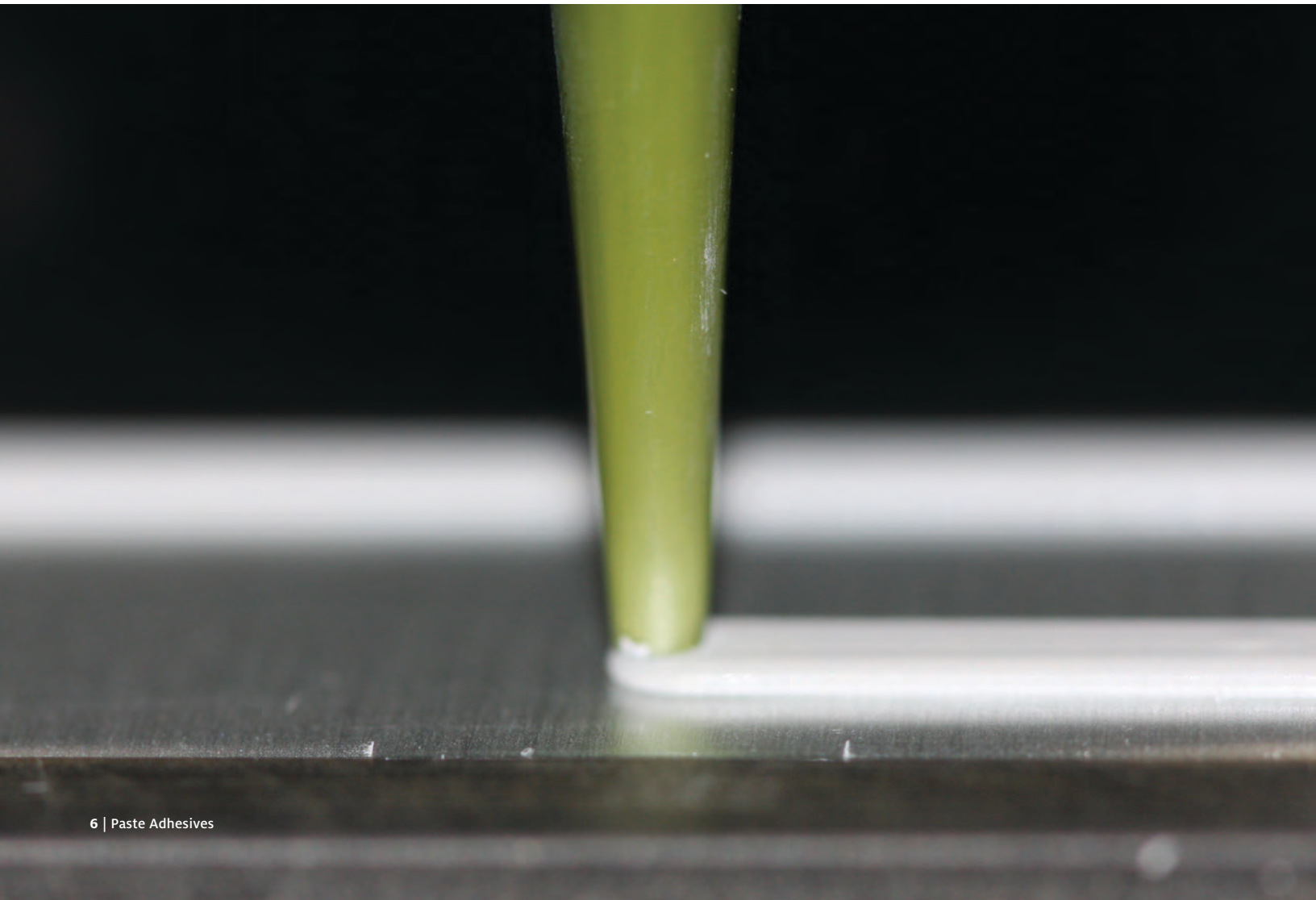
PASTE ADHESIVES

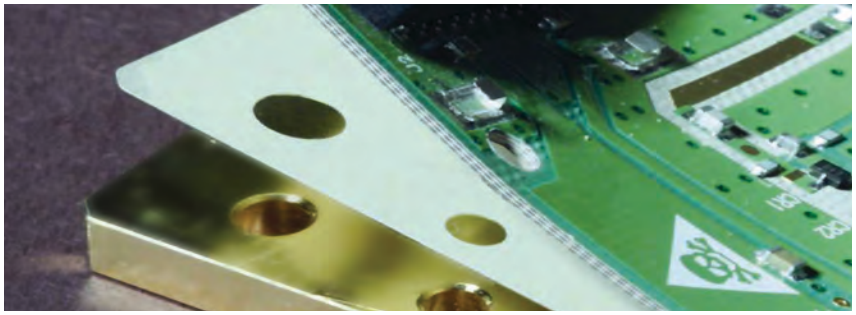
ELECTRICALLY CONDUCTIVE

PRODUCT	DESCRIPTION	VISCOSITY (cP)	VOLUME RESISTIVITY (Ω•cm)	THERMAL CONDUCTIVITY (W/m•K)	LAP SHEAR STRENGTH (psi)	CURE CONDITION
LOCTITE *ABLESTIK* 84-1LMIT1	Dispensable and screen-printable paste for the most demanding applications needing both excellent electrical and thermal conductivity.	22,000	1×10^{-4}	3.6	1,885	1 hr. at 150°C
LOCTITE *ABLESTIK* 967-1	Low-temperature cure, electrically conductive paste with reduced risk to delicate components and increased manufacturing throughput with a quick cure.	14,000	1.5×10^{-2}	2	1,200	2 hr. at 180°C
LOCTITE *ABLESTIK* 8700E	Large chip attach material with excellent performance in thermal cycling for long life expectancy.	19,000	2×10^{-4}	1.6	–	2 hr. at 160°C
LOCTITE *ABLESTIK* 85-1	Gold-filled paste that eliminates migration or corrosion concerns and easily tunes high-frequency modules .	` paste	8×10^{-4}	2	1,800	1 hr. at 150°C
LOCTITE *ABLESTIK* 56C	High electrically and thermally conductive two-component adhesive.	thixotropic paste	2×10^{-4}	3	870	2 hr. at 50°C
LOCTITE *ABLESTIK* QMI529HT-LV	High electrically and thermally conductive adhesive with good dispensing. Stable at high temperatures and reflow temperatures.	16,000	5×10^{-5}	8	–	1 hr. at 175°C
LOCTITE *ABLESTIK* CE 3104WXL	Stencil- or screen-printable solder replacement that is compatible with tin or tin-containing metal surfaces.	65,000	8×10^{-4}	2	1,300	8 min. at 125°C
LOCTITE *ABLESTIK* 57C A/B	Two-component adhesive with convenient 1-to-1 mix ratio and high electrical and thermal conductivity.	thixotropic paste	6×10^{-4}	7	700	3 hr. at 65°C
LOCTITE *ABLESTIK* CE 8500	Low-stress adhesive with high temperature characteristics and low modulus.	120,000	5×10^{-4}	4	450	40 min. at 150°C
LOCTITE *ABLESTIK* 3880	Syringe- or stencil-dispensed, silver, conductive adhesive for solder replacement. Long work life. Can be stored in conventional refrigerator.	100,000	6×10^{-4}	> 2	600	6 min. at 150°C
LOCTITE *ABLESTIK* 2902	Two-component, room-temperature cure, general-purpose, conductive adhesive.	20,000	6×10^{-4}	3	1,600	24 hr. at 25°C
LOCTITE *ABLESTIK* CE 3103WLV	Dispensable solder replacement that is compatible with tin or tin-containing metal surfaces.	20,000	8×10^{-4}	2	1,890	10 min. at 120°C
LOCTITE *ABLESTIK* 8175	Electrically conductive paste with a proven history for large die attach applications where CTE mismatch is an issue.	55,000	5×10^{-4}	3.2	1,650	30 min. at 150°C

ELECTRICALLY INSULATING

PRODUCT	DESCRIPTION	VISCOSITY (cP)	VOLUME RESISTIVITY (Ω•cm)	THERMAL CONDUCTIVITY (W/m•K)	LAP SHEAR STRENGTH (psi)	CURE CONDITION
LOCTITE® *ABLESTIK* 84-3	Electrically insulating material for chip attach applications that eliminates concerns of reliability and outgassing.	50,000	3.5×10^{13}	0.83	2,700	1 hr. at 150°C
LOCTITE ABLESTIK 958-11	Flexible, electrically insulating paste that manages applications where CTE mismatch is an issue.	45,000	5.0×10^{14}	0.5	2,700	1 hr. at 150°C
LOCTITE ABLESTIK 8700K	Hybrid component attach material with excellent performance in thermal cycling for long life expectancy.	45,000	3.5×10^{14}	0.5	–	1 hr. at 175°C
LOCTITE ABLESTIK 104 A/B	Two-component adhesive with high strength and chemical resistance. Designed for applications requiring very high temperature exposures.	25,000	1.0×10^{15}	0.5	1,800	3 hr. at 150°C
LOCTITE ABLESTIK 724-14C	Polyurethane adhesive with excellent adhesion even in cryogenic conditions. Can be cured at room and elevated temperatures.	500,000	1.0×10^{10}	0.9	1,700	72 hr. at 25°C
LOCTITE ABLESTIK 2151	Two-component, thermally conductive adhesive that develops strong, durable high-impact bonds at room temperature.	40,000	2.0×10^{15}	1.0	2,850	24 hr. at 25°C





FILM ADHESIVES

ELECTRICALLY CONDUCTIVE

PRODUCT	DESCRIPTION	VOLUME RESISTIVITY (Ω•cm)	THERMAL CONDUCTIVITY (W/m•K)	LAP SHEAR STRENGTH (psi)	CURE CONDITION
LOCTITE ABLESTIK 5025E	High conductivity and low flow enable efficient manufacturing and high performance. Also available in gold-filled version.	2.0×10^{-4}	7	3,000	30 min. at 150°C
LOCTITE ABLESTIK ECF 561E	Electrically conductive film with a proven history for substrate attach, heat sink and grounding applications in aerospace applications.	1.0×10^{-3}	1.6	2,000	1 hr. at 150°C
LOCTITE ABLESTIK ECF 563	Low squeeze-out during bonding. Provides RF/EMI shielding in bonding microwave substrates into packages.	4.0×10^{-3}	1.0	2,500	30 min. at 150°C
LOCTITE ABLESTIK CF 3350	High-purity, low-outgassing, electrically conductive film with resistance to moisture and chemical corrosion.	4.0×10^{-4}	7	3,400	30 min. at 150°C
LOCTITE ABLESTIK CF 3366	Low-temperature cure, high-flow film with reduced risk to delicate components. The combination of adhesive properties ensures reliable RF ground plane performance.	3.0×10^{-4}	7	1,750	1 hr. at 150°C
LOCTITE ABLESTIK CF 3352	Good electrical and thermal conductivity for mechanical assembly applications. The combination of adhesive properties ensures reliable RF ground plane performance.	3.0×10^{-3}	7	2,150	30 min. at 150°C
LOCTITE ABLESTIK ECF 564A	Silver-filled epoxy film with high strength particularly suitable for an array of difficult-to-bond substrates.	4.0×10^{-4}	2.2	2,200	2 hr. at 150°C
LOCTITE ABLESTIK ECF 564AHF	Silver-filled epoxy film designed for use in hybrid packages where outgassing and ionic contamination must be kept to a minimum. This material is a higher-flow version of *LOCTITE ABLESTIK* ECF 564A.	4.0×10^{-4}	3.0	2,500	2 hr. at 150°C

ELECTRICALLY INSULATING AND THERMALLY CONDUCTIVE

PRODUCT	DESCRIPTION	VOLUME RESISTIVITY (Ω•cm)	THERMAL CONDUCTIVITY (W/m•K)	LAP SHEAR STRENGTH (psi)	CURE CONDITION
LOCTITE ABLESTIK 550K	High-strength material that is particularly suitable for an array of difficult-to-bond substrates.	7.2×10^{12}	0.8	3,300	30 min. at 150°C
LOCTITE ABLESTIK 561K	High-strength, flexible, electrically insulating film manages applications where CTE mismatch is an issue.	1.0×10^{13}	0.8	3,300	30 min. at 150°C
LOCTITE ABLESTIK 563K	Electrically insulating, high-strength film with high thermal conductivity. Provides high strength over a wider temperature range than is normally associated with flexible films.	1.0×10^{13}	1.1	3,000	30 min. at 150°C
LOCTITE ABLESTIK 5020K	Excellent adhesion to gold-plated surfaces and high strength ensure the integrity of hermetic packages.	8.0×10^{14}	0.7	3,000	1 hr. at 150°C
BERGQUIST BOND-PLY TBP 800-1	Thermally conductive, fiberglass-reinforced, pressure-sensitive adhesive tape. No curing required.	1.0×10^{11}	0.8	150	N/A
BERGQUIST BOND-PLY TBP 1400LMS-HD	Heat-curable, low-modulus silicone adhesive designed for assembly-level CTE mismatch, shock and high-vibration applications.	1.0×10^{11}	1.4	200	30 min. at 125°C or 6 min. at 160°C

CIRCUIT BOARD PROTECTION MATERIALS

CONFORMAL COATING

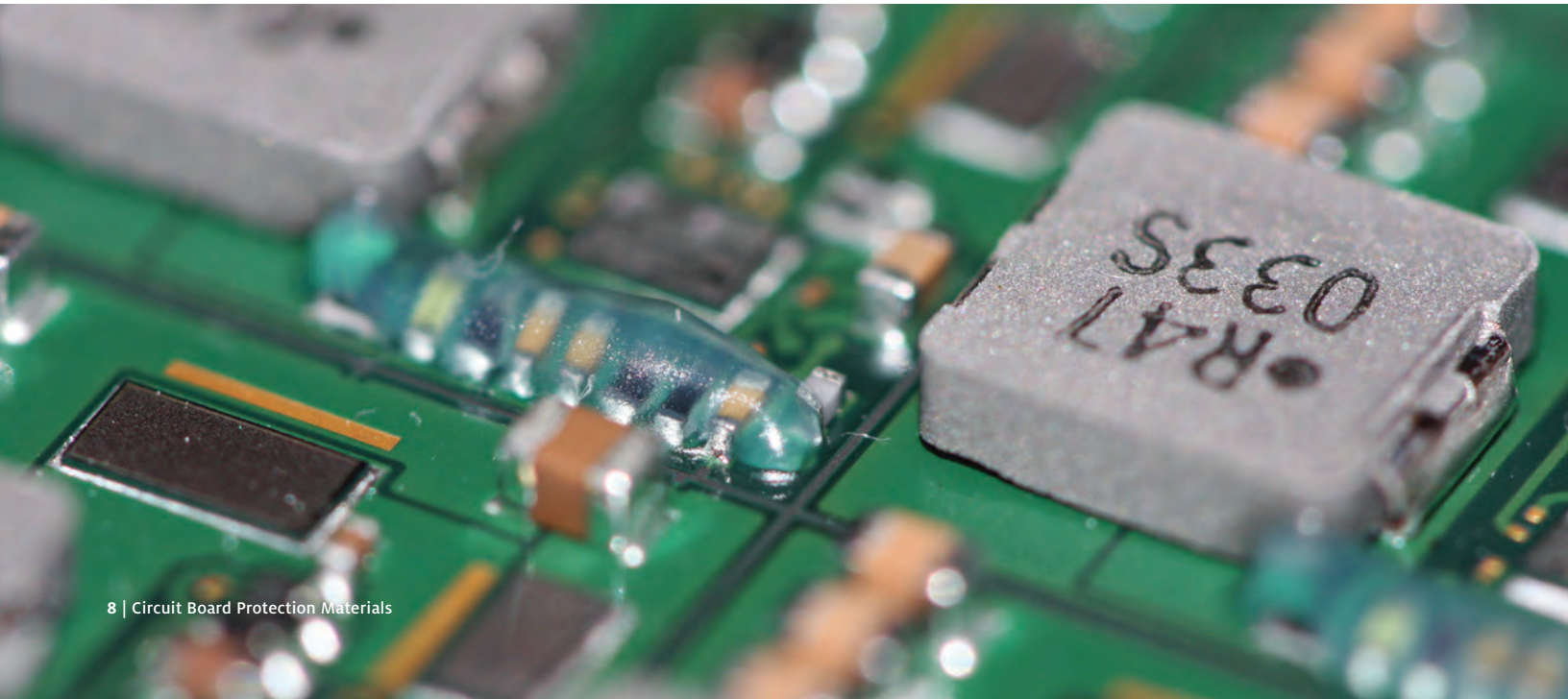
PRODUCT	DESCRIPTION	VISCOSITY (cP)	VOLUME RESISTIVITY (Ω • cm)	CURE CONDITION	STORAGE LIFE
LOCTITE® *STYCAST* UV 7993	Environmentally friendly, UV-conformal coating for rugged protection without limiting manufacturing throughput.	120	2.2×10^{16}	UV tack, 50% humidity, 25°C for 100 hr.	6 months at 125°C
LOCTITE STYCAST PC 20M	Clear, air-dry, solvent-based, acrylic conformal coating with excellent toughness and abrasion resistance.	1,500	1.04×10^{16}	Air-dry for 30 – 45 min. + 45 min. at 75°C	18 months at -40°C
LOCTITE STYCAST PC 40-UMF	100% solids, acrylated urethane conformal coating specifically formulated to rapidly gel and immobilize when exposed to UV light and then fully cure when exposed to atmospheric moisture.	250	3.5×10^{16}	10 sec. at 300 – 600 mW/cm², 365 nm + moisture cure for 2 – 3 days at room temperature (RT)	16 months at -40°C

ENCAPSULANTS

PRODUCT	DESCRIPTION	VISCOSITY (cP)	WORK LIFE (days)	GLASS TRANSITION TEMPERATURE, T_g (°C)	COEFFFICIENT OF THERMAL EXPANSION,CTE (ppm/°C)		CURE CONDITION	STORAGE LIFE AT -40°C (months)
					Below T_g	Above T_g		
LOCTITE ECCOBOND FP4451TD	Tall dam version of *LOCTITE ECCOBOND* FP4451 for applications requiring a taller, narrower dam encapsulant. Ionically clean.	300,000	10	150	21	65	30 min. at 125°C + 90 min. at 165°C	12
LOCTITE ECCOBOND FP4460	High-purity, low-stress, glob-top encapsulant with high moisture resistance and long working life.	300,000	2	173	20	60	3 hr. at 150°C	9
LOCTITE ECCOBOND FP4470	Fill encapsulant that is a high-adhesion version of *LOCTITE ECCOBOND* FP4450 capable of 260°C L3 Joint Electron Device Engineering Council (JEDEC) performance.	42,000	3	148	18	65	30 min. at 125°C	9

PEELABLE MASK

PRODUCT	DESCRIPTION	COLOR	SLUMP RESISTANCE	SHORE HARDNESS	VISCOSITY AT 163°C
TECHNOMELT® AS 8998	Peelable hot melt adhesive used to mask off areas that need protection before conformal coating is applied. Formulated to have excellent slump resistance.	Translucent Yellow	Up to 100°C	10A	2,900 to 4,000 cP

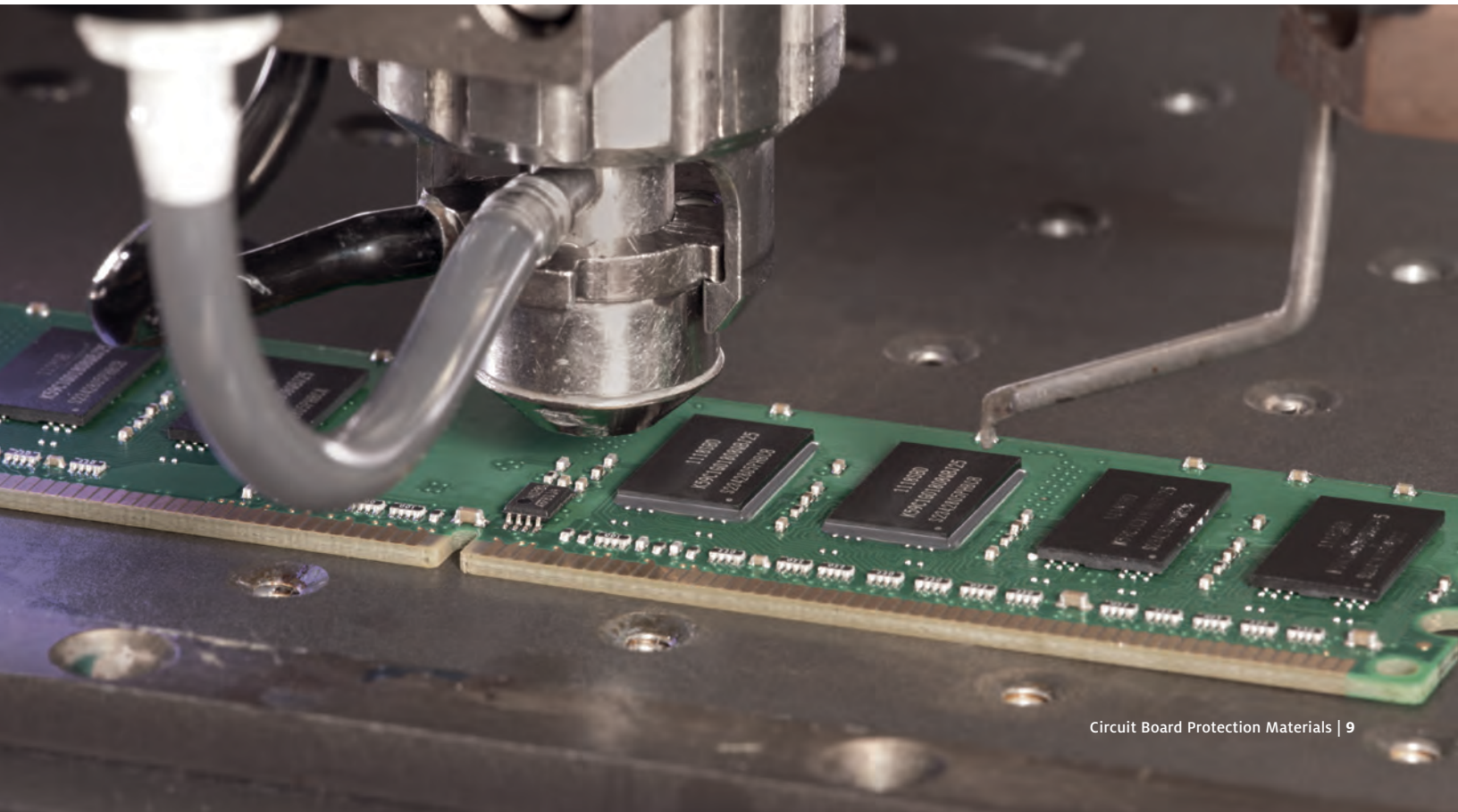


POTTING

PRODUCT	DESCRIPTION	NASA OUTGASSING APPROVED	VISCOSITY, (cP)	VOLUME RESISTIVITY (Ω•cm)	WORK LIFE (hours)	CURE CONDITION
LOCTITE STYCAST 2651	Low-outgassing encapsulant with excellent adhesion to a wide variety of substrates.	Yes	25,000	5.0×10^{16}	4	1 hr. at 120°C
LOCTITE STYCAST 2850FT	Low-outgassing encapsulant with high thermal conductivity and thermal shock resistance.	Yes	5,600	1.0×10^{15}	4	1 hr. at 120°C

UNDERFILL

PRODUCT	DESCRIPTION	VISCOSITY (cP)	WORK LIFE (hours)	GLASS TRANSITION TEMPERATURE, T_g (°C)	COEFFFICIENT OF THERMAL EXPANSION, CTE (ppm/°C)		CURE CONDITION	STORAGE LIFE AT -40°C (months)
					Below T_g	Above T_g		
LOCTITE ECCOBOND FP4531	Snap-curable, low-CTE underfill for high thermal cycle performance. Designed for flip chip on flex applications.	10,000	8	161	28	104	7 min. at 160°C	9
LOCTITE ECCOBOND E 1172A	Low-CTE underfill for high thermal cycle performance. Formulated for use with very fine area array devices where transparent processing is critical.	17,000	48	135	27	72	6 min. at 135°C	6
LOCTITE ECCOBOND UF 3812	Reworkable underfill with room temperature flow. High glass transition temperature and high fracture toughness enable excellent protection of solder joints during thermal cycling.	350	24	131	48	175	10 min. at 130°C	6
LOCTITE ECCOBOND 3517M	Reworkable underfill with low temperature cure designed for solder joint protection against mechanical stress.	2,600	168	78	65	191	5 min. at 120°C	6



SOLDER MATERIALS

LIQUID FLUX

PRODUCT	DESCRIPTION	SOLIDS CONTENT (%)	ACID VALUE (mg KOH/g)	IPC/J-STD-004 CLASSIFICATION	APPLICATION
LOCTITE® HYDX-20	Water-soluble flux formulated for use on electronic assemblies designed for water cleaning.	20	24	ORH1	Spray/Foam

SOLDER PASTE

PRODUCT	DESCRIPTION	APPLICATION	ALLOY	PARTICLE SIZE DISTRIBUTION	IPC/J-STD-004 CLASSIFICATION	OPTIMAL SHELF LIFE
LOCTITE GC 3W	Halogen-free, room-temperature stable, Pb-free, water-wash paste. RoHS-compliant with excellent resistance to high humidity, improved stability storage and extended stencil life.	Soldering SMT assemblies	SAC305	Type 3, 4	ORM0	6 months up to 26.5°C
LOCTITE GC 10	Halogen-free, room-temperature stable, Pb-free, no-clean paste. RoHS-compliant with excellent resistance to high humidity. Excellent paste-transfer efficiency. Improved stability at different storage and operating temperatures, with extended stencil life and abandon time.	Soldering SMT assemblies	SAC305	Type 3, 4, 4.5 (4A), 5	ROL0	12 months up to 26.5°
LOCTITE HF 2W	Halogen-free, water-wash paste. REACH-compliant with excellent resistance to humidity and slump. Residues easily removed with aqueous cleaner.	Soldering SMT assemblies	63S4 SN63	Type 3, 3C, 4	ORM0	6 months at 0° – 10°C
LOCTITE HF 212	Halogen-free, low-voiding, no-clean paste. RoHS-compliant with excellent fine pitch coalescence and extended stencil life and abandon time. Compatible with many Pb-free alloys.	Soldering SMT assemblies	90iSC SAC0307 SAC305 SAC387	Type 3, 4, 4.5 (4A), 5	ROL0	6 months at 0° – 10°C

THERMAL CLAD INSULATED METAL SUBSTRATES

MULTI-LAYER

PRODUCT	DESCRIPTION	THICKNESS (in.)	THERMAL PERFORMANCE (°C/W)	THERMAL IMPEDANCE (°C in/W)	THERMAL CONDUCTIVITY (W/m•K)	DIELECTRIC BREAKDOWN VOLTAGE (kVac)
BERGQUIST TCLAD TIP/TIC HT	Dielectric resistant to degradation from high-temperature exposure. Features high dielectric breakdown characteristics. Proven in applications such as LED, power conversion, heat-rails, solid state relays and motor drives.	0.009	0.90	0.16	4.1	20
		0.006	0.70	0.11	4.1	11
BERGQUIST TCLAD TDL CML	Circuit Material Laminate (CML) available as prepreg form only for customer bonding.	0.006	1.10	0.21	N/A	10

SINGLE-LAYER

PRODUCT	DESCRIPTION	THICKNESS (in.)	THERMAL PERFORMANCE (°C/W)	THERMAL IMPEDANCE (°C in/W)	THERMAL CONDUCTIVITY (W/m•K)	DIELECTRIC BREAKDOWN VOLTAGE (kVac)
BERGQUIST TCLAD TIP/TIC HPL	Dielectric, specifically formulated for high-power lighting LED applications with demanding thermal performance requirements.	0.0015	0.30	0.02	7.5	5.0
BERGQUIST TCLAD TIP/TIC HT	Dielectric resistant to degradation from high temperature exposure. Features high dielectric breakdown characteristics.	0.003	0.45	0.05	4.1	8.5
		0.006	0.70	0.11	4.1	11.0
BERGQUIST TCLAD TIP/TIC MP	Industry-proven dielectric for a multitude of applications including LED, power conversion, heat-rails, solid state relays and motor drives.	0.003	0.65	0.09	2.4	8.5

THERMAL INTERFACE MATERIALS

GAP FILLER

PRODUCT	DESCRIPTION	COLOR	THERMAL CONDUCTIVITY (W/m•K)	VOLUME RESISTIVITY (Ω•m)	HARDNESS, BULK RUBBER (Shore 00)	DIELECTRIC BREAKDOWN VOLTAGE (V/mil)
BERGQUIST GAP FILLER TGF 1100SF	Silicone-free, two-part, liquid-dispensed, gap-filling material. Cures to a soft, flexible elastomer, helping reduce thermal cycling stresses in the application.	Yellow	1.1	1.0×10^{10}	60	400
BERGQUIST GAP FILLER TGF 1800LVO	Low-volatility chemistry designed for silicone-sensitive applications. Shear-thinning characteristics create little to no stress during assembly.	Yellow	1.8	1.0×10^{10}	80	400
BERGQUIST GAP FILLER TGF 3500LVO	High-performance, two-part, liquid gap-filling material with significantly lower levels of silicone outgassing.	Blue	3.5	1.0×10^{10}	40	275

GAP PAD®

PRODUCT	DESCRIPTION	COLOR	THERMAL CONDUCTIVITY (W/m•K)	VOLUME RESISTIVITY (Ω-m)	HARDNESS, BULK RUBBER (Shore 00)	DIELECTRIC BREAKDOWN VOLTAGE (V)
BERGQUIST GAP PAD® TGP 1000VOUS	Exceptionally soft material and highly conformable gap filling material.	Mauve/Pink	1.0	1.0×10^{11}	5	> 6,000
BERGQUIST GAP PAD® TGP 2200SF	Silicone-free, fiberglass-reinforced thermal pad for silicone-sensitive applications.	Green	2.0	1.0×10^{8}	70	> 5,000
BERGQUIST GAP PAD® TGP HC3000	Soft and compliant, highly tacky for excellent wet-out characteristics for rough or uneven surface topographies.	Blue	3.0	1.0×10^{10}	15	> 5,000
BERGQUIST GAP PAD® TGP HC5000	High-performance pad ideal for applications requiring low stress on components and boards during assembly.	Violet	5.0	1.0×10^{10}	35	> 5,000
BERGQUIST GAP PAD® TGP 6000ULM	Ultra low-modulus, gap filling pad with exceptional thermal conductivity, designed for high-performance applications requiring extremely low-assembly stress.	Grey	6.0	1.0×10^{10}	N/A	> 5,000

SIL PAD®

PRODUCT	DESCRIPTION	COLOR	THERMAL CONDUCTIVITY (W/m•K)	VOLUME RESISTIVITY (Ω•m)	HARDNESS	DIELECTRIC BREAKDOWN VOLTAGE (V)
BERGQUIST SIL PAD® TSP 1800	Highly robust and cut-through-resistant thermal pad designed for low- and high-pressure applications.	Black	1.8	1.0×10^{9}	80 (Shore 00)	> 6,000
BERGQUIST SIL PAD® TSP A2000	Exceptional thermal and dielectric performance under high clamping pressures.	Green	2.0	1.0×10^{11}	80 (Shore A)	> 6,000
BERGQUIST SIL PAD® TSP 3500	High-performance, thermally conductive insulator designed for demanding aerospace and avionics applications.	White	3.5	1.0×10^{11}	90 (Shore A)	> 4,000
BERGQUIST SIL PAD® TSP Q2500	Low-cost, high-performance alternative to thermal grease. Thermally conductive compound coated on an aluminum substrate.	Black	2.5	1.0×10^{2}	93 (Shore A)	Non-insulating

PHASE CHANGE MATERIAL

PRODUCT	DESCRIPTION	COLOR	THERMAL CONDUCTIVITY (W/m•K)	VOLUME RESISTIVITY (Ω•m)	PHASE CHANGE TEMPERATURE (°C)	DIELECTRIC BREAKDOWN VOLTAGE (V)
BERGQUIST HI-FLOW THF 1000F-AC	Aluminum-reinforced, thermally conductive phase change compound, offering exceptionally low thermal impedance at minimal bond lines.	Black	1.0	Non-insulating	55	Non-insulating
BERGQUIST HI-FLOW THF 1500P	Thermally conductive phase change compound coated over a polyimide substrate, designed for applications demanding high thermal performance and cut-through resistance.	Gold	1.5	1.0×10^{12}	52	> 5000

LOCTITE®
TECHNOMELT®

BERGQUIST®

AMERICAS

UNITED STATES
Henkel Corporation
14000 Jamboree Road
Irvine, CA 92606
United States
Tel: +1.888.943.6535
Fax: +1.714.368.2265

Henkel Corporation
20021 Susana Road
Rancho Dominguez, CA 90221
United States
Tel: +1.310.764.4600
Fax: +1.310.605.2274

Henkel Corporation
18930 W. 78th Street
Chanhassen, MN 55317
United States
Tel: +1.952.835.2322
Tel: +1.800.347.4572
Fax: +1.952.835.0430

BRAZIL
Henkel Brazil
Av. Prof. Vernon Krieble, 91
06690-070 Itapevi, Sao Paulo
Brazil
Tel: +55.11.3205.7001
Fax: +55.11.3205.7100

ASIA-PACIFIC

CHINA
Henkel Management Center
Building 7, No. 99 Jiang Wan Cheng Road
Shanghai 200438,
China
Tel: +86.21.2891.8000
Fax: +86.21.2891.8952

ABLESTIK (Shanghai) LIMITED
No. 332 Meigui South Road
WaiGaoQiao Free Trade Zone, Pu Dong
Shanghai 200131,
China
Tel: +86.21.2702.5888
Fax: +86.21.5048.4169

JAPAN
Henkel Japan Ltd.
27-7, Shin Isogo-cho
Isogo-ku Yokohama, 235-0017
Japan
Tel: +81.45.286.0161
Email: jp.ae-csdesk@henkel.com

KOREA
Henkel Korea Co Ltd.
18th Floor of tower B, BYC High City Bldg
Gasan Digital 1-ro, Geumcheon-gu,
Seoul, 08506
South Korea
Tel: +82.2.6150.3000
Fax: +82.2.6947.5203

SINGAPORE
Henkel Singapore Pte Ltd.
401, Commonwealth Drive
#03-01/02 Haw Par Technocentre,
Singapore 149598
Tel: +65.6266.0100
Fax: +65.6472.8738 / +65.6266.1161

TAIWAN
Henkel Taiwan Ltd.
10F, No. 866, Zhongzheng Road,
Zhonghe District, New Taipei City, 23586
Taiwan
Tel: +866.2.2227.1988
Fax: +866.2.2226.8699

EUROPE

BELGIUM
Henkel Belgium N.V.
Nijverheidsstraat 7
B-2260 Westerlo
Belgium
Tel: +32.1457.5611
Fax: +32.1458.5530

UNITED KINGDOM
Henkel Ltd.
Adhesives Limited Technologies House
Wood Lane End
Hemel Hempstead
Hertfordshire HP2 4RQ
United Kingdom
Tel: +44.1442.278000
Fax: +44.1442.278071

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