

# PRODUCT INFORMATION

PRODUCT	<div>(TYPICAL PROPERTIES)</div> <div>These should not be considered as specifications.</div> <div>KEY TOUGH-SEAL 21 (KEY PC2021A/B)</div> <div>SEALANT FOR THERMAL CYCLING</div>																										
DESCRIPTION	KEY Tough-Seal 21 is a tough and durable two component, fast gelling, hybrid epoxy elastomer electrical potting compound with excellent thermal cycling performance. KEY Tough-Seal has the flexibility of a urethane and the service temperature of an epoxy. It maintains this exceptional flexibility from -40°C to 150°C (-40°F to 300°F) and it resists contraction and won't pull back during thermal cycles so it protects sensitive electronics. Since KEY Tough-Seal is an epoxy and not a urethane, it is isocyanate-free and has a mild health and safety profile. KEY Tough-Seal is ideal for electrical potting applications requiring thermal cycling and thermal shock resistance and low embedment stress.																										
ADVANTAGES & APPLICATIONS	✓ Excellent Thermal Cycling Performance & Thermal Shock Resistance ✓ Resilient, Tough, Durable, High Elongation ✓ Low Embedment Stress on Electronics, Low Shrinkage ✓ Adhesion to Thermoplastics and Wire Insulation, Specific Adhesion to Aluminum																										
PHYSICAL PROPERTIES <div>(Typical)</div>	<table><tr><td></td><td>Tough-Seal 21 A</td><td>Tough-Seal 21 B</td><td>MIX</td></tr><tr><td>Color</td><td>Off White</td><td>Black</td><td>Grey / Black</td></tr><tr><td>Viscosity at 25°C</td><td>7,000 cP</td><td>11,000 cP</td><td>10,000 cP</td></tr><tr><td>Brookfield RVT</td><td>#5 @ 20 rpm</td><td>#5 @ 20 rpm</td><td>#5 @ 20 rpm</td></tr><tr><td>Specific Gravity</td><td>1.32</td><td>1.28</td><td>1.29</td></tr><tr><td>Density (lbs/gal)</td><td>11.0</td><td>10.7</td><td>10.8</td></tr></table>				Tough-Seal 21 A	Tough-Seal 21 B	MIX	Color	Off White	Black	Grey / Black	Viscosity at 25°C	7,000 cP	11,000 cP	10,000 cP	Brookfield RVT	#5 @ 20 rpm	#5 @ 20 rpm	#5 @ 20 rpm	Specific Gravity	1.32	1.28	1.29	Density (lbs/gal)	11.0	10.7	10.8
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CURED PROPERTIES <div>(Typical)</div>	<table><tr><td>Property</td><td>ASTM</td><td>Temperature</td><td>Value</td></tr><tr><td>Elongation at Break</td><td>D638</td><td>25°C (77°F)</td><td>225%</td></tr><tr><td>Hardness, Shore A</td><td>D2240</td><td>25°C (77°F)</td><td>64A</td></tr></table> <div>Comprehensive electrical &amp; thermal mechanical properties are listed on following pages. Visit <a href="#">tough-seal.com</a> for greater discussion on the features of Tough-Seal 21.</div>			Property	ASTM	Temperature	Value	Elongation at Break	D638	25°C (77°F)	225%	Hardness, Shore A	D2240	25°C (77°F)	64A												
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INSTRUCTIONS FOR USE	<table><tr><td>MIX RATIO By</td><td>WEIGHT</td><td>VOLUME</td></tr><tr><td>KEY Tough-Seal 21 Part A</td><td>51 A</td><td>1 A</td></tr><tr><td>KEY Tough-Seal 21 Part B</td><td>100 B</td><td>2 B</td></tr></table> <div>Combine Part A and B and mix thoroughly, being careful to limit entrapped air during mixing. Scrape sides, walls and bottom of container. Pour material into part and cure. Bulk meter-mix dispensing machines and convenient cartridges provide air free mixing.</div>			MIX RATIO By	WEIGHT	VOLUME	KEY Tough-Seal 21 Part A	51 A	1 A	KEY Tough-Seal 21 Part B	100 B	2 B															
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SAFETY & HANDLING	<div>PLEASE READ MATERIAL SAFETY DATA SHEET BEFORE USING.</div> <div>Avoid all contact with skin, eyes, clothing and food. Wash thoroughly after handling.</div>																										
SHELF LIFE & STORAGE INFO <div>For Unopened, Factory Sealed Containers</div>	<table><tr><td>KEY Tough-Seal 21A (PC2021A)</td><td>3 Months from Date of Manufacture (15°C to 35°C)</td></tr><tr><td>KEY Tough-Seal 21A (PC2021A)</td><td>12 Months from Date of Manufacture (-18°C to 3°C)</td></tr><tr><td>KEY Tough-Seal 21B (PC2021B)</td><td>12 Months from Date of Manufacture (-18°C to 35°C)</td></tr><tr><td>KEY Tough-Seal 21 Cartridges</td><td>3 Months from Date of Shipment (15°C to 35°C)</td></tr><tr><td>KEY Tough-Seal 21 Cartridges</td><td>12 Months from Date of Shipment (-18°C to 3°C)</td></tr></table>			KEY Tough-Seal 21A (PC2021A)	3 Months from Date of Manufacture (15°C to 35°C)	KEY Tough-Seal 21A (PC2021A)	12 Months from Date of Manufacture (-18°C to 3°C)	KEY Tough-Seal 21B (PC2021B)	12 Months from Date of Manufacture (-18°C to 35°C)	KEY Tough-Seal 21 Cartridges	3 Months from Date of Shipment (15°C to 35°C)	KEY Tough-Seal 21 Cartridges	12 Months from Date of Shipment (-18°C to 3°C)														
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DCO# 2877 Revision AD

## KEY POLYMER

CORPORATION

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SPECIALTY CHEMICAL COMPOUNDS

17 Shepard Street, Lawrence, MA 01843-1023 ■ 978/683-9411 ■ FAX 978/686-7729

# PRODUCT INFORMATION

PRODUCT	<div>(TYPICAL PROPERTIES)</div> <div>These should not be considered as specifications.</div> <div>KEY TOUGH-SEAL 21 (KEY PC2021A/B)</div> <div>SEALANT FOR THERMAL CYCLING</div>				
CURED PROPERTIES (Typical) Page 2	Electrical Properties		ASTM	Temperature	Value
	Dielectric Strength		D149	25°C (77°F)	350 Volts/mil
	Volume Resistivity		D257	25°C (77°F)	1.2 x 10 <sup>12</sup> Ω-cm
	Dielectric Constant	1 MHz	D150	25°C (77°F)	5.00
		1 kHz	D150	25°C (77°F)	5.50
		60 Hz	D150	25°C (77°F)	5.75
	Dissipation Factor	1 MHz	D150	25°C (77°F)	0.026
		1 kHz	D150	25°C (77°F)	0.028
		60 Hz	D150	25°C (77°F)	0.064
	Thermal Properties		ASTM	Condition	Value
	Heat Capacity, Cp		E1461	25°C (77°F)	1.37 J/g°K
	Thermal Conductivity		E1461	25°C (77°F)	0.26 W/m°K
	Coefficient of Thermal Expansion		E831 E1545	-65°C to 75°C	135 ppm/°C
				75°C to 100°C	0 ppm/°C
				100°C to 150°C	75 ppm/°C
	Mechanical Properties		ASTM	Condition	Value
	Tensile Strength		D638	25°C (77°F)	450 psi
	Elongation at Break		D638	25°C (77°F)	225%
	Linear Shrinkage (Upon Cure)		D2256	25°C (77°F)	<0.001 in/in
	Hardness vs Temperature Shore A		D2240	-75°C (-103°F)	88 A
			D2240	-25°C (-13°F)	75 A
			D2240	5°C (41°F)	69 A
			D2240	25°C (77°F)	64 A
			D2240	50°C (122°F)	62 A
			D2240	66°C (150°F)	61 A
			D2240	80°C (176°F)	62 A
			D2240	100°C (212°F)	57 A
			D2240	120°C (248°F)	51 A
			D2240	150°C (302°F)	47 A
	Hardness vs RT Cure	1 Hour	D2240	25°C (77°F)	15 A
2 Hours		D2240	25°C (77°F)	26 A	
4 Hours		D2240	25°C (77°F)	31 A	
8 Hours		D2240	25°C (77°F)	35 A	
12 Hours		D2240	25°C (77°F)	35 A	
1 Day		D2240	25°C (77°F)	39 A	
2 Days		D2240	25°C (77°F)	46 A	
3 Days		D2240	25°C (77°F)	52 A	
4 Days		D2240	25°C (77°F)	57 A	
1 Week		D2240	25°C (77°F)	60 A	
1 Month	D2240	25°C (77°F)	68 A		

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# PRODUCT INFORMATION

## PRODUCT

## KEY TOUGH-SEAL 21 (KEY PC2021A/B) SEALANT FOR THERMAL CYCLING

(TYPICAL PROPERTIES)

These should not be considered as specifications.

## CURED PROPERTIES (Typical) Page 3

METALLIC ADHESION	ASTM	Temperature	Value
Tensile Lap Shear Strength, 1" x 4" Adherands, 20 mil bondline gap, 1 inch overlap Co = Cohesive Bond Mode Ad = Adhesive Bond Mode			
Aluminum Bare	D1002	25°C (77°F)	540 psi [Co]
Steel Bare	D1002	25°C (77°F)	530 psi [Ad]
Steel Ground	D1002	25°C (77°F)	480 psi [Co]
Primed Steel	D1002	25°C (77°F)	530 psi [Co]
Galvanized Steel	D1002	25°C (77°F)	560 psi [Co]
Tin Plated Steel	D1002	25°C (77°F)	470 psi [Co]
Chrome Plated Steel	D1002	25°C (77°F)	560 psi [Co]
FRP ADHESION	ASTM	Temperature	Value
Tensile Lap Shear Strength, 1" x 4" Adherands, 20 mil bondline gap, 1 inch overlap Co = Cohesive Bond Mode Ad = Adhesive Bond Mode			
FRP - Polyester Fiberglass	D3163	25°C (77°F)	540 psi [Co]
Garolite G-9 Melamine/Glass	D3163	25°C (77°F)	530 psi [Co]
Garolite G-10 Epoxy/Glass	D3163	25°C (77°F)	550 psi [Co]
Garolite XX Phenolic/Paper	D3163	25°C (77°F)	570 psi [Co]
THERMOPLASTIC ADHESION	ASTM	Temperature	Value
Tensile Lap Shear Strength, 1" x 4" Adherands, 20 mil bondline gap, 1 inch overlap Co = Cohesive Bond Mode Ad = Adhesive Bond Mode			
Acrylic	D3163	25°C (77°F)	560 psi [Co]
Acrylic / PVC	D3163	25°C (77°F)	430 psi [Co]
PVC - Polyvinyl Chloride	D3163	25°C (77°F)	530 psi [Co]
CPVC - Chlorinated PVC	D3163	25°C (77°F)	660 psi [Co]
ABS Acrylonitrile Butadiene Styrene	D3163	25°C (77°F)	500 psi [Co]
PETG Polyethylene Terephthalate	D3163	25°C (77°F)	610 psi [Co]
Lexan - Polycarbonate	D3163	25°C (77°F)	520 psi [Co]
Nylon 6/6 - Polyamide	D3163	25°C (77°F)	520 psi [Co]
Polypropylene	D3163	25°C (77°F)	50 psi [Ad]
Polyethylene LDPE	D3163	25°C (77°F)	20 psi [Ad]
Polyethylene HDPE	D3163	25°C (77°F)	40 psi [Ad]
Teflon PTFE Polytetrafluoroethylene	D3163	25°C (77°F)	40 psi [Ad]
Noryl Polyphenylene Oxide/Polystyrene	D3163	25°C (77°F)	220 psi [Ad]
Ultem - Polyetherimide	D3163	25°C (77°F)	540 psi [Co]

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# CONDITIONS

Seller does not accept any terms or conditions of sale or make any warranties, expressed or implied, other than those contained in this Statement or in any existing written contract between the seller and buyer covering Key Polymer Corporation Products.

## **ORDER ACCEPTANCE:**

Orders are accepted upon the understanding that seller is not obligated to make delivery by any specified date nor liable for damage due to delay or failure in filling order caused by contingencies beyond its control. If delivery dates are specified, they are estimates only and not guaranteed. In the event of unreasonable delay in filling order, buyer may cancel same on written notice to seller, provided said order is not then in process of manufacture.

## **EXCISE TAXES:**

The amount of excise taxes on the production, sale, delivery or transportation of material covered hereby shall be paid by the buyer.

## **DISCLAIMER OF LIABILITY:**

As the conditions or methods of use are beyond our control, we do not assume any responsibility and expressly disclaim any liability for any use of this material. Information contained herein is believed to be true and accurate, but all statements or suggestions are made without warranty, express or implied, regarding accuracy of the information, the hazards connected with the use of the material or the results to be obtained from the use thereof. Compliance with all applicable federal, state and local laws and regulations remains the responsibility of the user.

Buyer shall make an examination both as to quantity and quality of any material delivered hereunder immediately upon receipt and failure of buyer to give notice of any claims within 15 days after receipt of such material shall be an unqualified acceptance of such material and a waiver by buyer of all claims with respect hereto.

## **USERS RESPONSIBILITY:**

Key Polymer product usage suggestions, bulletins and manuals cannot cover all possible situations which the user may experience during processing. Each aspect of your operation should be examined if or where additional precautions or procedures may be necessary. All health and safety information contained in Key Polymer's Material Safety Data Sheets for the products being used should be provided to all employees with exposure to the product. It is the responsibility of the user to provide this information in this manner and to use the information to develop appropriate work practice guidelines and employee instructional programs.

## **LIABILITY LIMITATION:**

Buyer assumes all risk and liability for the results obtained by the use of any material delivered by Key Polymer in the manufacturing processes of buyer or in combination with other substances in manufacturing and repair processes of buyer or in combination with other substances. No claim of any kind, whether as to material delivered or for non-delivery of material, shall be greater in amount than the purchase price of this material in respect of which such claim is made.

**KEY POLYMER CORP.  
LAWRENCE, MA 01843**

REV AA      DCO # 0588  
February 3, 2003