

# PRODUCT INFORMATION

<b>PRODUCT</b>	<i>(TYPICAL PROPERTIES)</i>		
	These should not be considered as specifications.		
<b>PRODUCT</b>	<b>KEY TOUGH-SEAL 21</b> (KEY PC2021A/B) <b>SEALANT FOR THERMAL CYCLING</b>		
<b>DESCRIPTION</b>	<b>KEY Tough-Seal 21</b> is a tough and durable two component, fast gelling, hybrid epoxy elastomer electrical potting compound with excellent thermal cycling performance. <b>KEY Tough-Seal</b> 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 <b>KEY Tough-Seal</b> is an epoxy and not a urethane, it is isocyanate-free and has a mild health and safety profile. <b>KEY Tough-Seal</b> is ideal for electrical potting applications requiring thermal cycling and thermal shock resistance and low embedment stress.		
<b>ADVANTAGES &amp; APPLICATIONS</b>	<ul style="list-style-type: none"> <li>✓ Excellent Thermal Cycling Performance &amp; Thermal Shock Resistance</li> <li>✓ Resilient, Tough, Durable, High Elongation</li> <li>✓ Low Embedment Stress on Electronics, Low Shrinkage</li> <li>✓ Adhesion to Thermoplastics and Wire Insulation, Specific Adhesion to Aluminum</li> </ul>		
<b>PHYSICAL PROPERTIES</b> <i>(Typical)</i>		<b>Tough-Seal 21 A</b>	<b>Tough-Seal 21 B</b>
	<b>MIX</b>		
	Color	Off White	Black
	Viscosity at 25°C	7,000 cP	11,000 cP
	Brookfield RVT	#5 @ 20 rpm	#5 @ 20 rpm
	Specific Gravity	1.32	1.28
	Density (lbs/gal)	11.0	10.7
	Grey / Black		10,000 cP
	#5 @ 20 rpm		#5 @ 20 rpm
	1.29		10.8
<b>CURED PROPERTIES</b> <i>(Typical)</i>	<b>Property</b>	<b>ASTM</b>	<b>Temperature</b>
	Elongation at Break	D638	25°C (77°F)
	Hardness, Shore A	D2240	25°C (77°F)
			225%
			64A
	<i>Comprehensive electrical &amp; thermal mechanical properties are listed on following pages. Visit <a href="http://tough-seal.com">tough-seal.com</a> for greater discussion on the features of Tough-Seal 21.</i>		
<b>CURE SCHEDULE</b> <i>(Typical)</i>	<b>Gel Time (100g):</b>		10 minutes at 25°C (77°F)
	<b>Hard Cure</b>		Overnight at 25°C (77°F)
	<b>Full Cure</b>		3 to 5 Days, Dependent on part size
	<b>Accelerated Cure</b>		Yes, Mild Heating 66 to 80°C (150-175°F)
<b>INSTRUCTIONS FOR USE</b>	<b>MIX RATIO By</b>	<b>WEIGHT</b>	<b>VOLUME</b>
	KEY Tough-Seal 21 Part A	51 A	1 A
	KEY Tough-Seal 21 Part B	100 B	2 B
	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.		
<b>SAFETY &amp; HANDLING</b>	<b>PLEASE READ MATERIAL SAFETY DATA SHEET BEFORE USING.</b>		
	Avoid all contact with skin, eyes, clothing and food. Wash thoroughly after handling.		
<b>SHELF LIFE &amp; STORAGE INFO</b> <i>For Unopened, Factory Sealed Containers</i>	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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# KEY POLYMER

CORPORATION

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SPECIALTY CHEMICAL COMPOUNDS

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

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<b>CURED PROPERTIES</b> <i>(Typical) Page 2</i>	<b>Electrical Properties</b>					
		<b>ASTM</b>	<b>Temperature</b>	<b>Value</b>		
	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
				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
				D150	25°C (77°F)	0.064
	<b>Thermal Properties</b>					
		<b>ASTM</b>	<b>Condition</b>	<b>Value</b>		
	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		
	<b>Mechanical Properties</b>					
		<b>ASTM</b>	<b>Condition</b>	<b>Value</b>		
	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	25°C (77°F)	15 A			
		2 Hours	26 A			
		4 Hours	31 A			
		8 Hours	35 A			
		12 Hours	35 A			
		1 Day	39 A			
		2 Days	46 A			
		3 Days	52 A			
		4 Days	57 A			
		1 Week	60 A			
1 Month	68 A					

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<b>CURED PROPERTIES</b> <i>(Typical) Page 3</i>	<b>METALLIC ADHESION</b>	<b>ASTM</b>	<b>Temperature</b>	<b>Value</b>
	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]
	<b>FRP ADHESION</b>	<b>ASTM</b>	<b>Temperature</b>	<b>Value</b>
	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]
	<b>THERMOPLASTIC ADHESION</b>	<b>ASTM</b>	<b>Temperature</b>	<b>Value</b>
	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**

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February 3, 2003