

PRODUCT INFORMATION

PRODUCT	<i>(TYPICAL PROPERTIES)</i> These should not be considered as specifications.			
	TOUGH-SEAL 31 A/B (KEY PC2031A/B) SEALANT FOR THERMAL CYCLING			
DESCRIPTION	<p>Tough-Seal 31 is a tough and durable two component, hybrid epoxy elastomer that features a lower viscosity than Tough-Seal 21. Tough-Seal is a superior electrical potting compound with excellent thermal cycling performance. 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 Tough-Seal is an epoxy and not a urethane, it does not incorporate isocyanates and Tough-Seal has a mild health and safety profile. Tough-Seal is ideal for electrical potting applications requiring thermal cycling and thermal shock resistance and low embedment stress.</p>			
ADVANTAGES & APPLICATIONS	<ul style="list-style-type: none"> ✓ 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 <i>(Typical)</i>		Tough-Seal 31 A	Tough-Seal 31 B	MIX
	Color	Off White	Black	Grey / Black
Viscosity at 25°C Brookfield RVT	3,500 cP #5 @ 20 rpm	7,000 cP #5 @ 20 rpm	5,000 cP #5 @ 20 rpm	
Specific Gravity	1.15	1.02	1.07	
Density (lbs/gal)	9.6	8.5	8.9	
CURED PROPERTIES <i>(Typical)</i>	Property	ASTM	Temperature	Value
	Elongation at Break	D638	25°C (77°F)	400%
	Hardness, Shore A	D2240	25°C (77°F)	37A
<i>Comprehensive electrical & thermal mechanical properties are listed on following pages. Visit tough-seal.com for greater discussion on the features of Tough-Seal 31.</i>				
CURE SCHEDULE <i>(Typical)</i>	Gel Time (100g):		10-20 minutes at 25°C (77°F)	
	Hard Cure		Overnight at 25°C (77°F)	
	Full Cure		3 to 5 Days, Dependent on part size	
	Accelerated Cure		Yes, Mild Heating 66 to 80°C (150-175°F)	
INSTRUCTIONS FOR USE	MIX RATIO By	WEIGHT	VOLUME	
	Tough-Seal 31 Part A	57 A	1 A	
	Tough-Seal 31 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.				
SAFETY & HANDLING	PLEASE READ MATERIAL SAFETY DATA SHEET BEFORE USING. Avoid all contact with skin, eyes, clothing and food. Wash thoroughly after handling.			
SHELF LIFE & STORAGE INFO <i>For Unopened, Factory Sealed Containers</i>	Tough-Seal 31A (PC2031A)	3 Months from Date of Manufacture (15°C to 35°C)		
	Tough-Seal 31A (PC2031A)	12 Months from Date of Manufacture (-18°C to 3°C)		
	Tough-Seal 31B (PC2031B)	12 Months from Date of Manufacture (-18°C to 35°C)		
	Tough-Seal 31AB Cartridges	3 Months from Date of Shipment (15°C to 35°C)		
	Tough-Seal 31AB Cartridges	12 Months from Date of Shipment (-18°C to 3°C)		

KEY POLYMER
CORPORATION

All sales subject to DCO# 2440 Revision AE conditions on reverse side.

SPECIALTY CHEMICAL COMPOUNDS

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

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CURED PROPERTIES

(Typical) Page 2

Electrical Properties		ASTM	Temperature	Value
Dielectric Strength		D149	25°C (77°F)	325 Volts/mil
Volume Resistivity		D257	25°C (77°F)	2.1 x 10 ¹² Ω-cm
Dielectric Constant	1 MHz	D150	25°C (77°F)	4.75
	1 kHz	D150	25°C (77°F)	5.2
	60 Hz	D150	25°C (77°F)	5.35
Dissipation Factor	1 MHz	D150	25°C (77°F)	0.024
	1 kHz	D150	25°C (77°F)	0.021
	60 Hz	D150	25°C (77°F)	0.044
Thermal Properties		ASTM	Condition	Value
Heat Capacity, Cp		E1461	25°C (77°F)	1.75 J/g°K
Thermal Conductivity		E1461	25°C (77°F)	0.18 W/m°K
Coefficient of Thermal Expansion		E831 E1545	-65°C to 75°C	168 ppm/°C
			75°C to 100°C	168 ppm/°C
			100°C to 150°C	168 ppm/°C
Mechanical Properties		ASTM	Condition	Value
Tensile Strength		D638	25°C (77°F)	800 psi
Elongation at Break		D638	25°C (77°F)	400 %
Linear Shrinkage (Upon Cure)		D2256	25°C (77°F)	<0.001 in/in
Hardness vs Temperature Shore A		D2240	-75°C (-103°F)	87 A
		D2240	-25°C (-13°F)	50 A
		D2240	5°C (41°F)	44 A
		D2240	25°C (77°F)	37 A
		D2240	50°C (122°F)	37 A
		D2240	66°C (150°F)	37 A
		D2240	80°C (176°F)	37 A
		D2240	100°C (212°F)	37 A
		D2240	120°C (248°F)	35 A
		D2240	150°C (302°F)	33 A
Hardness vs RT Cure		D2240	25°C (77°F)	4 A
		D2240	25°C (77°F)	6 A
		D2240	25°C (77°F)	11 A
		D2240	25°C (77°F)	14 A
		D2240	25°C (77°F)	14 A
		D2240	25°C (77°F)	16 A
		D2240	25°C (77°F)	19 A
		D2240	25°C (77°F)	22 A
		D2240	25°C (77°F)	23 A
		D2240	25°C (77°F)	30 A
		D2240	25°C (77°F)	41 A

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	TOUGH-SEAL 31 A/B (KEY PC2031A/B) SEALANT FOR THERMAL CYCLING			
CURED PROPERTIES <i>(Typical) Page 3</i>	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)	470 psi [Co]
	Steel Bare	D1002	25°C (77°F)	260 psi [Ad]
	Steel Ground	D1002	25°C (77°F)	280 psi [Ad]
	Primed Steel	D1002	25°C (77°F)	150 psi [Ad]
	Galvanized Steel	D1002	25°C (77°F)	260 psi [Ad]
	Tin Plated Steel	D1002	25°C (77°F)	250 psi [Co]
	Chrome Plated Steel	D1002	25°C (77°F)	250 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)	180 psi [Ad]
	Garolite G-9 Melamine/Glass	D3163	25°C (77°F)	130 psi [Ad]
	Garolite G-10 Epoxy/Glass	D3163	25°C (77°F)	130 psi [Ad]
	Garolite XX Phenolic/Paper	D3163	25°C (77°F)	190 psi [Ad]
	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)	110 psi [Ad]
	Acrylic / PVC	D3163	25°C (77°F)	120 psi [Ad]
	PVC - Polyvinyl Chloride	D3163	25°C (77°F)	150 psi [Ad]
	CPVC - Chlorinated PVC	D3163	25°C (77°F)	170 psi [Ad]
	ABS Acrylonitrile Butadiene Styrene	D3163	25°C (77°F)	120 psi [Ad]
	PETG Polyethylene Terephthalate	D3163	25°C (77°F)	100 psi [Ad]
	Lexan - Polycarbonate	D3163	25°C (77°F)	90 psi [Ad]
	Nylon 6/6 - Polyamide	D3163	25°C (77°F)	160 psi [Ad]
Polypropylene	D3163	25°C (77°F)	40 psi [Ad]	
Polyethylene LDPE	D3163	25°C (77°F)	10 psi [Ad]	
Polyethylene HDPE	D3163	25°C (77°F)	40 psi [Ad]	
Teflon PTFE Polytetrafluoroethylene	D3163	25°C (77°F)	20 psi [Ad]	
Noryl Polyphenylene Oxide/Polystyrene	D3163	25°C (77°F)	170 psi [Ad]	
Ultem - Polyetherimide	D3163	25°C (77°F)	100 psi [Ad]	

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.

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

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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.
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