

Quantum Composites develops and manufactures Engineered Structural Composite (ESC) sheet molding compounds and high performance conductive molding compounds.

Quantum's high strength, high temperature materials are used to replace conventional structural materials including aluminum, cast & sheet metals. Advantages provided by QC, Lytex<sup>®</sup>, AMC<sup>®</sup> and Pentex<sup>™</sup> materials from Quantum include weight reduction, parts consolidation, conductivity and corrosion resistance. Markets served include Transportation, Industrial, Marine, Utilities, Aerospace, Defense, Sporting Equipment, Safety and Construction. Quantum offers design and engineering support, materials and new application development, tool design, prototype and molding / process development that meet the demands of innovative Original Equipment Manufacturers (OEMs) and Custom Molders in a broad range of markets.

Quantum Composite's high performance materials include:

- **VINYL ESTER** We manufacture a wide variety of vinyl ester ESC materials offering high strength, high temperature resistance, corrosion resistance, and other characteristics. Of special interest is QC-8800, an unusually high strength, tough material. QC-8560 exhibits particularly good elevated temperature properties. Other QC-8000 series materials include different resin matrices and other variations
- **EPOXY** Lytex<sup>®</sup> glass fiber reinforced epoxy Engineered Structural Composites (ESC). Lytex 9063 meets a number of military and aerospace company specifications, while Lytex 4149 is reinforced with chopped carbon fibers. All Lytex Series 4000 materials are based on this same resin matrix.
- **AMC<sup>®</sup>** A series of very high performance, glass or carbon fiber reinforced in vinyl ester, polyimide, and other matrices..
- **ENHANCED POLYESTER** Our enhanced polyesters provide heat resistance and high strength at a moderate price.
- **PEMTEX<sup>™</sup>** A series of conductive, high performance, thermoset composite molding compound with corrosion resistant properties. Primary application is in the fabrication of bi polar plates for use in Proton Exchange Membrane (PEM) fuel cells.

<sup>®</sup> Lytex is a registered trademark of Quantum Composites, Inc.

## Vinyl Ester ESC - Engineered Structural Composites

### Typical Properties

Vinyl Ester ESC Engineered Structural Composites	Vinyl Ester	Vinyl Ester	Vinyl Ester	Vinyl Ester	Vinyl Ester	Vinyl Ester
	<u>QC-8560</u>	<u>QC-8700</u>	<u>QC-8770</u>	<u>QC-8777</u>	<u>QC-8816*</u>	<u>QC-8800</u>
<b>Reinforcement % by weight.</b>	60%	63%	63%	35%-40%	66%	63%
<b>Reinforcement % by volume</b>	45%	46%	46%	18%-20%	50%	47%
<b>Reinforcement Length</b>	1/2" chopped glass	1" chopped glass	1" chopped glass	1" chopped glass	continuous uni glass	1" chopped glass
<b>Specific Gravity</b> grams/ cc	1.90	1.87	1.85	1.30	1.95	1.90
<b>Density</b> lbs./cu. in.	0.0687	0.0676	0.0668	0.047	0.0705	0.0687
<b>Polymeric Shrinkage</b> in./in.	0.001	0.001	0	0.001		0
<b>Flexural Strength</b> D-790 psi	62,000	92,000	80,000	34,000	160,000	85,000
<b>Flexural Modulus</b> D-790 psi x 10 <sup>6</sup>	2.6	3.0	2.9	1.65	6.0	3.0
<b>Tensile Strength</b> D-638 psi	38,000	52,000	50,000	15,200	90,000	50,000
<b>Tensile Modulus</b> D-638 x 10 <sup>6</sup>	3.9	3.9	3.5	1.38		3.8
<b>Comp. Strength</b> D-695 psi	56,000					42,000
<b>Comp. Modulus</b> D-695 psi x 10 <sup>6</sup>						2.7
<b>Notched Izod</b> D-256 ft.lbs/in	24	33	35	18	70	36
<b>Poison's Ratio</b>		0.386				0.447
<b>Properties</b>	Maintains excellent mechanical properties above 125 <sup>0</sup> C	Unusual toughness. Excellent fatigue resistance.	Unusual toughness. Excellent fatigue resistance.	Very low density. Excellent strength to weight ratio.	For very high strength in one direction.	Extremely tough. Excellent for impact loads.
<b>Molding suggestions</b>	Vinyl Ester ESC compounds can be molded over a range of temperatures and pressures. For parts up to 0.5"thick, a molding temperature of 270 <sup>0</sup> - 300 <sup>0</sup> F is suggested, as a starting point, with molding pressure of 300 to 1000 psi. For molding thicker sections, the molding temperature should be reduced. Cure times will depend on par thickness and mold temperature. For example a 0.25" section, with a mold temperature of 275 <sup>0</sup> F – 300 <sup>0</sup> F will cure in 3 to 5 minutes.					

\* QC-8816 contains continuous, unidirectional fibers. Care must be taken during the molding process to insure that fibers don't move and kink. It can be co-molded with other SMC materials to provide selective improvements of properties.

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Tensile and Flexural Properties for chopped glass ESC materials are determined using net shape molded specimens. Values obtained on cut specimens will typically be lower.

## **Lytex<sup>®</sup> (Epoxy) ESC - Engineered Structural Composites**

### **Typical Properties**

<b>Lytex<sup>®</sup> (Epoxy) ESC Engineered Structural Composite</b>	<b>Epoxy</b>	<b>Epoxy</b>
	<b>Lytex<sup>®</sup> 9063</b>	<b>Lytex<sup>®</sup> 4129</b>
<b>Reinforcement % by weight.</b>	63%	63%
<b>Reinforcement % by volume.</b>	45%	45%
<b>Reinforcement Length</b>	1/2"	1/2"
<b>Reinforcement Material</b>	chopped glass	chopped glass
<b>Specific Gravity grams/ cc</b>	1.82	1.82
<b>Density lbs./cu. in.</b>	0.0658	0.0658
<b>Polymeric Shrinkage in./in.</b>	0.001	0.001
<b>Flexural Strength D-790 psi</b>	66,000	64,000
<b>Flexural Modulus D-790 psi x 10<sup>6</sup></b>	2.6	2.4
<b>Tensile Strength D-638 psi</b>	35,000	38,000
<b>Tensile Modulus D-638 psi x 10<sup>6</sup></b>	2.3	
<b>Comp. Strength D-695 psi</b>	25,000	
<b>Comp. Modulus D-695 psi x 10<sup>6</sup></b>	1.9	
<b>Notched Izod D-256 ft.lbs/in</b>	35	35
<b>Poison's Ratio</b>	0.3	
<b>Tg, DMA D-4065</b>	347 F	
<b><u>Properties</u></b>		Extended shelf life
	Excellent mechanical properties, good retention of mechanical properties at elevated temperatures, good chemical resistance and excellent electrical properties	
<b>Molding Suggestions</b>	Uncured Lytex compound should have a minimum exposure to moisture. Dielectric preheating to 140 <sup>0</sup> - 160 <sup>0</sup> F is recommended as an aid in proper shaping and placing of the mold charge. Mold temperatures in the range of 250 <sup>0</sup> - 325 <sup>0</sup> F can be utilized, with 275 <sup>0</sup> F suggested as a starting point. Cure times depend upon mold temperature and part thickness and will typically be 5 - 10 minutes. Detailed molding suggestions are available on request.	

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## **Carbon Fiber Reinforced ESC – Engineered Structural Composites**

### **Typical Properties**

<b>Carbon Fiber Reinforced (Epoxy &amp; Vinyl Ester) ESC Engineered Structural Composites</b>	<b>Epoxy</b>	<b>Epoxy</b>	<b>Vinyl Ester</b>
	<b><u>Lytex 4149</u></b>	<b><u>Lytex 4181</u></b>	<b><u>AMC-8590</u></b>
<b>Reinforcement % by weight</b>	55%	52%	55%
<b>Reinforcement % by volume</b>	52%	49%	53%
<b>Reinforcement Length</b>	1” 3k	1” 12k	1”
<b>Reinforcement type</b>	chopped carbon	chopped carbon	chopped carbon
<b>Specific Gravity grams/ cc</b>	1.45	1.45	1.48
<b>Density lbs./cu. in.</b>	0.0524	0.0524	0.0535
<b>Polymeric Shrinkage in./in.</b>	0	0	0
<b>Flexural Strength D-790 psi</b>	89,000	60,000	80,000
<b>Flexural Modulus D-790 psi x 10<sup>6</sup></b>	5.0	4.5	5.0
<b>Tensile Strength D-638 psi</b>	42,000	30,000	36,000
<b>Tensile Modulus D-680 psi x 10<sup>6</sup></b>	8.0		7.0
<b>Comp. Strength D-695 psi</b>	40,000		
<b>Comp. Modulus D-695 psi x 10<sup>6</sup></b>	4.6		
<b>Notched Izod D-256 ft.lbs/in</b>	18	15	
<b>Poisson's Ratio</b>			0.501
<b>Tg, DMA D-4065</b>	347° F	347° F	245° F
<b>Properties</b>	Toughened Vinyl Ester. Fatigue Resistant. High Heat Resistance		Toughened Vinyl Ester. Fatigue Resistant. High Heat Resistance
<b>Molding Suggestions</b>	Uncured Lytex compound should have a minimum exposure to moisture. Dielectric preheating to 140 - 160° F is recommended as an aid in proper shaping and placing of the mold charge. Mold temperatures in the range of 250 - 325° F can be utilized, with 275° F suggested as a starting point. Cure times will be depend upon mold temperature and part thickness and will typically be 5 - 10 minutes. Detailed molding suggestions are available on request.		AMC-8590 can be molded at temperatures in the range of 260 - 310° F with 280° F suggested as a starting point. Cure times will be dependent on mold temperature and part thickness and will typically be 5 - 10 minutes. Detailed molding suggestions are available on request.

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## Enhanced Polyester ESC - Engineered Structural Composites

### Typical Properties

Enhanced Polyester ESC Engineered Structural Composites	Enhanced Polyester QC-3450	Enhanced Polyester QPC-1977	Enhanced Polyester QC-7810
<b>Reinforcement %</b> by wgt.	48%	50%	58%
<b>Reinforcement %</b> by vol.	67%	36%	43%
<b>Reinforcement Length</b>	1/2"	1"	1/2"
<b>Reinforcement Material</b>	chopped glass	Chopped glass	chopped glass
<b>Specific Gravity</b> grams/ cc	1.71	1.70	1.90
<b>Density</b> lbs./cu. in.	0.0618		0.0687
<b>Polymeric Shrinkage</b> in./in.	0.0005	0.001	0.001
<b>Flexural Strength</b> D-790 psi	48,000	45,000	70,000
<b>Flexural Modulus</b> D-790 psi x 10 <sup>6</sup>	2.1	2.1	2.5
<b>Tensile Strength</b> D-638 psi	27,000	28,000	47,000
<b>Tensile Modulus</b> D-638 psi x 10 <sup>6</sup>		2.6	
<b>Comp. Strength</b> D-695 psi	28,500	25,000	
<b>Comp. Modulus</b> D-695 psi x 10 <sup>6</sup>	1.69		
<b>Notched Izod</b> D-256 ft.lbs/in	27	25	32
<b>Properties</b>	For long term use up to 375 <sup>0</sup> F	Very good strength. Resistance to elevated temperatures	For high strength electrical applications UL recognized
<b>Molding suggestions</b>	Can be molded over a range of temperatures & pressures. Part thickness 0.5" or less 270 <sup>0</sup> - 300 <sup>0</sup> F is suggested as a starting point, with molding pressure of 500 - 1000 psi. Reduce temperature for thicker sections (e.g. 260 <sup>0</sup> F as a starting point for 2.0" section. A 0.25" section will cure in 3 - 5 minutes. For max temperature resistance post curing is suggested, 1 hour at 325 <sup>0</sup> plus 8 -16 hours at 400 <sup>0</sup> F	Temperature 270 <sup>0</sup> - 315 <sup>0</sup> F Pressure 400 - 1200 psi, Cure time (1/8" section) 1.5 minutes @ 300 <sup>0</sup>	For part thickness of 0.5" or less, mold temperature of 270 <sup>0</sup> to 300 <sup>0</sup> F is a suggested starting point, with molding pressure of 300 to 1000 psi. For thicker sections the mold temperature should be reduced. Cure time will depend on part thickness

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