TORAY

Toray Composite Materials America, Inc.

3960 PREPREG SYSTEM

Toray's next-generation #3960 prepreg system demonstrates the next leap in performance of aerospace materials. Complementary pairing of the #3960 resin system with state-of-the-art T1100G carbon fiber provides the unparalleled properties expected of materials for the future. High toughness, exceptional tensile performance, and retention of hot/wet performance to 250°F (121°C) make the #3960 system the clear choice for the future demands of the aerospace industry.

High Heat Tolerance

High Tg and hot/wet performance enable retention of critical properties like open-hole compression to 121°C (250°F) without compromising material toughness.

Resin Chemistry

System features synergy with T1100G, capturing fiber's full capability and maximizing translation of carbon fiber strand strength.

Flexible Cure Methods

Proven flexibility in curing and consistency in mechanical properties has been achieved by oven cure and autoclave, with or without an intermediate dwell.

Flexible Processing

Prepreg can be suitably processed in either AFP or hand lay-up methodologies.

Laminate Toughness

Toray's proven interlayer toughening technology sets the standard for laminate impact resistance and fracture toughness.

www.toraycma.com
253-846-1777

AVAILABLE PRODUCT FORMATS

3960 resin is available with numerous types of unidirectional carbon fibers and woven and glass fabrics with Fiber Areal Weight (FAW) ranging from 70 g/m2 to 200 g/m2 and Resin Content, (RC%) by weight percent, ranging from 33.5% to 38%. Unidirectional products can be slit to widths between 1/8" and 60", and fabric products to widths above 6". Common product formats include: 1/4", 1/2", and 1.5" AFP spools (UD only); 6", 9", and 12" ATL rolls; and 24" to full width rolls for hand layup.

PART NUMBER	FIBER FORMAT	FIBER TYPE/STYLE	FAW (GSM)	RC % WEIGHT	ROLL WIDTH (IN)
P173EBN-19	Unidirectional	T1100G-24K	192	33.5	60
P173E0N-7	Unidirectional	T1100G-12K	70	40	39
FT6243R-3EI	Plain Weave	T1100G-12K	196	35	38

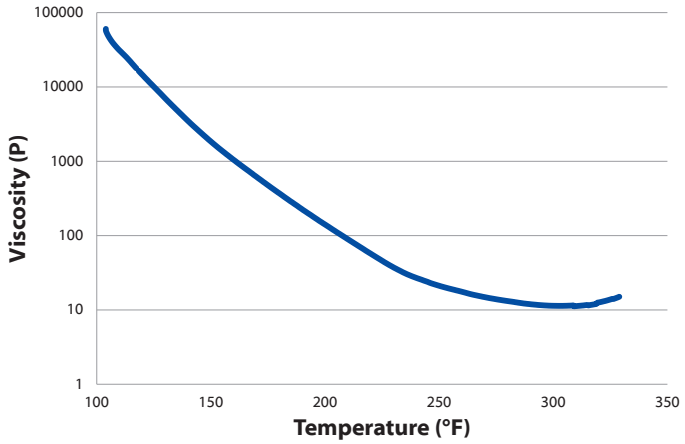
NEAT RESIN PHYSICAL PROPERTIES

PROPERTY	METHOD	UNITS	VALUE
Density	ASTM D792	g/cc	1.274
Tg (Dry)	DMA	°F (°C)	400 (204)
Tg (Wet)	DMA	°F (°C)	330 (166)
Minimum Viscosity	ASTM D4440	Poise	11.2
		°F (°C)	309 (154)

STORAGE LIFE

Out Life	42 days @ 75 °F (24 °C)
Freezer Life	3 years @ <10 °F (-12 °C)

RESIN VISCOSITY CURVE



Notes:
CTA: -65°F (-54°C), Ambient
RTA: 72°F (22°C), Ambient
ETW: 180°F (82°C), conditioned at 160°F/85% RH until equilibrium
Tension and compression values are normalized to the indicated CPT values

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Updated July 30, 2020

LAMINA/LAMINATE MECHANICAL PROPERTIES: P173EBN-19 (T1100G UD)

PROPERTY	SYMBOL	METHOD	UNITS	AUTOCLAVE			OVEN	
				CTA	RTA	ETW	CTA	RTA
0° Tensile Strength	F_{1t}	ASTM D3039	Ksi (MPa)	550 (3794)	565 (3896)	516 (3560)	519 (3578)	540 (3723)
90° Tensile Strength	F_{2t}	ASTM D3039	Ksi (MPa)	10.40 (71.7)	11.47 (79.1)	6.70 (46)	10.8 (74)	11.1 (77)
0° Tensile Modulus	E_{1t}	ASTM D3039	Msi (GPa)	25.1 (173)	25.1 (173)	27.1 (187)	25.1 (173)	24.9 (172)
90° Tensile Modulus	E_{2t}	ASTM D3039	Msi (GPa)	1.50 (10.3)	1.37 (9.5)	1.10 (8.0)	1.48 (10.2)	1.36 (9.4)
0° Compressive Strength	F_{1c}	SACMA SRM1R	Ksi (MPa)	283 (1951)	271 (1868)	236 (1627)	-	-
0° Compressive Strength	F_{1c}	ASTM D6641	Ksi (MPa)	-	-	-	243 (1675)	228 (1572)
90° Compressive Strength	F_{2c}	ASTM D6641	Ksi (MPa)	-	38.4 (265)	26.2 (181)	50.2 (346)	38.2 (263)
0° Compressive Modulus	E_{1c}	ASTM D6641	Msi (GPa)	-	22.0 (152)	21.8 (150)	22.6 (156)	22.0 (152)
90° Compressive Modulus	E_{2c}	ASTM D6641	Msi (GPa)	-	1.40 (9.7)	1.27 (8.8)	1.56 (10.8)	1.42 (9.8)
In-Plane Shear Strength @ Ultimate	F_{12}	ASTM D5379	Ksi (MPa)	-	-	15.2 (105)	16.0 (110)	18.0 (124)
In-Plane Shear Modulus	G_{12}	ASTM D5379	Msi (GPa)	-	-	0.53 (3.7)	0.77 (5.3)	0.90 (6.2)
Short Beam Shear Strength	SBS	ASTM D2344	Ksi (MPa)	-	16.5 (114)	10.0 (69)	23.2 (160)	17.0 (117)
Open Hole Compression Strength (QI: 25/50/25)	OHC	ASTM D6484	Ksi (MPa)	56.5 (390)	47.9 (330)	41.9 (289)	55.6 (383)	49.3 (340)
Compression After Impact (QI: 25/50/25) Impact at 1500 in-lbs (6.7J/mm)	CAI	ASTM D7137	Ksi (MPa)	-	49.5 (341)	-	-	-
Laminate Density	ρ	-	g/cc			1.573		
Fiber Volume Fraction	V_f	ASTM D792	%			56.8		
Cured Ply Thickness	CPT	-	Inch (mm)		0.0072 (0.183)		0.0073 (0.185)	

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LAMINA/LAMINATE MECHANICAL PROPERTIES: FT6243R-3EI (T1100G-12K PW)

PROPERTY	SYMBOL	METHOD	UNITS	AUTOCLAVE		
				CTA	RTA	ETW
0° Tensile Strength	F_{1t}	ASTM D3039	Ksi (MPa)	237 (1634)	261 (1799)	-
90° Tensile Strength	F_{2t}	ASTM D3039	Ksi (MPa)	239 (1644)	249 (1715)	-
0° Tensile Modulus	E_{1t}	ASTM D3039	Msi (GPa)	12.88 (88.79)	13.04 (89.92)	-
90° Tensile Modulus	E_{2t}	ASTM D3039	Msi (GPa)	12.87 (88.74)	12.81 (99.31)	-
0° Compressive Strength	F_{1c}	ASTM D6641	Ksi (MPa)	-	136 (938)	120.8 (833)
90° Compressive Strength	F_{2c}	ASTM D6641	Ksi (MPa)	-	-	114.3 (788)
0° Compressive Modulus	E_{1c}	ASTM D6641	Msi (GPa)	-	11.7 (81)	10.6 (73)
90° Compressive Modulus	E_{2c}	ASTM D6641	Msi (GPa)	-	-	11.4 (79)
In-Plane Shear Strength @ Ultimate	F_{12}	ASTM D5379	Ksi (MPa)	-	-	8.6 (59)
In-Plane Shear Modulus	G_{12}	ASTM D5379	Msi (GPa)	-	-	0.53 (3.7)
Short Beam Shear Strength	SBS	ASTM D2344	Ksi (MPa)	-	11.2 (77.4)	8.0 (55.1)
Open Hole Compression Strength (25/50/25)	OHC	ASTM D6484	Ksi (MPa)	-	48.0 (331)	-
Compression After Impact (25/50/25) Impact at 270in-lbs (6.7J/mm)	CAI	ASTM D7137	Ksi (MPa)	-	44.1 (304.2)	-
Laminate Density	ρ	-	g/cc	1.551		
Fiber Volume Fraction	V_f	ASTM D792	%	52.8		
Cured Ply Thickness	CPT	-	Inch (mm)	0.0079 (0.20)		

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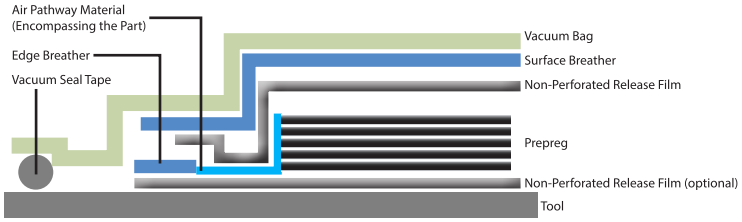
BAGGING PROCEDURE



Notes:

1. During layup, debulk after the first ply and then every 4 plies or as needed
2. The vacuum should be checked for leaks before beginning the cure cycle. The leak rate shall be less than 2.0 inches of Hg (7 kPa) over 5 minutes.

Please refer to the SDS for handling and disposal.

CURE CYCLE - AUTOCLAVE

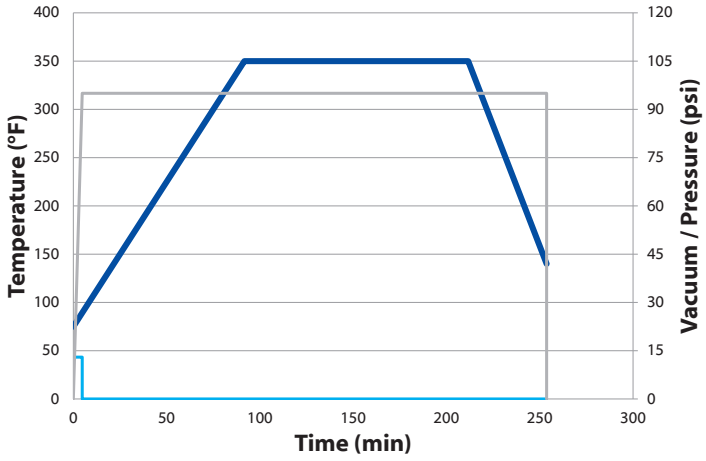
1. Apply full vacuum* to the part.
2. Apply 85 +15/-0 psi (586 +103/-0 kPa) autoclave pressure.
3. Vent the vacuum bag when the autoclave pressure reaches 20psi (138 kPa)
4. Ramp to 355 ± 10°F (179 ± 5°C) at a rate of 3.0 ± 2.0 °F (1.7 ± 1.1°C) per minute.
5. Hold for 120 - 180 minutes at 355 ± 10°F (180 ± 5°C).
6. Cool vessel to 140°F (60°C) or lower at a maximum rate of 5°F (2.78°C) per minute before releasing autoclave pressure.

CURE CYCLE - OVEN

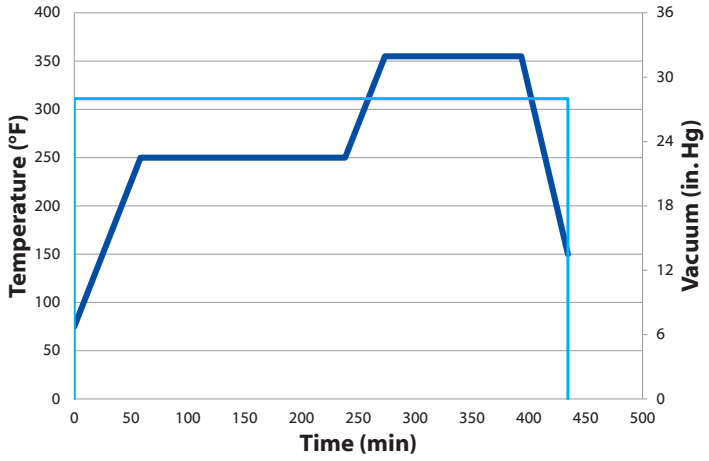
1. Apply full vacuum* to the part. Maintaining vacuum for at least three hours prior to beginning cure cycle is recommended for optimal part quality.
2. Ramp to 250 ± 10°F at 3 ± 2°F/min (45 ± 5°C at 1.7 ± 1.1°C/min)
3. Hold for 180 minutes at 250 ± 10°F
4. Ramp to 355 ± 10°F at 3 ± 2°F/min (180 ± 5°C at 1.7 ± 1.1°C°C/min)
5. Hold for 120 minutes at 355 ± 10°F
6. Cool to 150°F (65°C) or lower at a maximum ramp rate of 5°F/min (2.7°C/min).

** Required vacuum level varies depending on elevation. 28" Hg (95 kPa) is the recommended minimum at sea level under average conditions.*

AUTOCLAVE CURE PROCESS



OVEN CURE PROCESS



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