



HexTool® M61

Quasi-isotropic High Temperature Prepreg Tooling Compound



Product Data Sheet

Description

HexTool® Tooling Compound is randomly layered strips of uni-directional prepreg which is consolidated into rolled goods. It can be utilized as multi-ply quasi-isotropic hand lay-up, and subsequently CNC milled to close tolerance. HexTool® has proved to be dimensionally stable with the ability to hold vacuum integrity before and after machining, and after more than 500 part cure cycles. Fabricated from Hexcel's BMI resin HexPly® M61, HexTool® tools are ideally suited for 180°C (356°F) cure carbon fibre tools. This makes them lighter weight, more energy efficient than tools made of steel or Invar®, and more cost-effective with tighter mould tolerance than standard composites.

Benefits

- Ability to machine tool surface without distortion permitting the manufacture of tools with complex shapes and tight tolerances
- Lighter weight compared to metal tooling allowing easier handling and reduced infrastructure investment
- Faster heat-up and cool-down rates relative to metal tools facilitating reduced production costs
- Reparability and potential for modification of tool dimensions following engineering changes
- Formulated to withstand several hundred autoclave cycles at 180°C (356°F)
- Coefficient of thermal expansion to match carbon/epoxy
- Vacuum integrity following machining
- Rapid material deposition as HexTool® is much thicker than standard composite tooling prepregs





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Uncured Material Properties

Property	Value	Comment
Nominal Resin Content	38%	by weight
Nominal Bundle Size (Prepreg Strip Size)	8.0 mm x 50 mm (0.315 in. x 1.97 in.)	
Nominal HexTool® Ply Areal Weight	2000 g/m ² (0.41 lbs/ft ²) 4000 g/m ² (0.81 lbs/ft ²)	
Specific Gravity	1.55	
Autoclave Work life at 21°C (70°F)	20 days	
Storage Life	12 months	-18°C or below (0°F)

Cured Material Properties

Property	Value	Comment
NCured Ply Thickness: HexTool® M61 (2000) HexTool® M61 (4000)	1.27 mm (0.05 in.) 2.54 mm (0.10 in.)	Based on nominal prepreg properties
Tg Postcured	275°C (527°F)	dry
Maximum Use Temperature	218°C (425°F)	
Coefficient of Linear Thermal Expansion	(4.0 x 10 ⁻⁶ /°C)	(In Plane ASTM E289-95)
Minimum Initial Cure Temperature	190°C (375°F)	

* Cured material properties are for reference only and not to be considered certification values.

Mechanical Properties*

Property	Units	Condition	Temp °C	Method	Value
Tensile Strength	MPa (ksi)	Dry	23 (73)	ASTMD3039	260 (37.7)
			180 (356)	ASTMD3039	210 (30.5)
Tensile Modulus	GPa (msi)	Dry	23 (73)	ASTMD3039	41 (5.95)
			180 (356)	ASTMD3039	40 (5.80)
Compression Strength	MPa (ksi)	Dry	23 (73)	ASTMD6484	300 (43.5)
			180 (356)	ASTMD6484	270 (39.1)
Compression Modulus	GPa (msi)	Dry	23 (73)	ASTMD6484	32 (4.64)
			180 (356)	ASTMD6484	30 (4.35)
Flexural Strength	MPa (ksi)	Dry	23 (73)	ASTMD790	380 (55.1)
Flexural Modulus	GPa (msi)	Dry	23 (73)	ASTMD790	38 (5.51)
Short Beam Shear Strength	MPa (ksi)	Dry	23 (73)	EN2563	50 (7.3)
			180 (356)	EN2563	43 (6.2)

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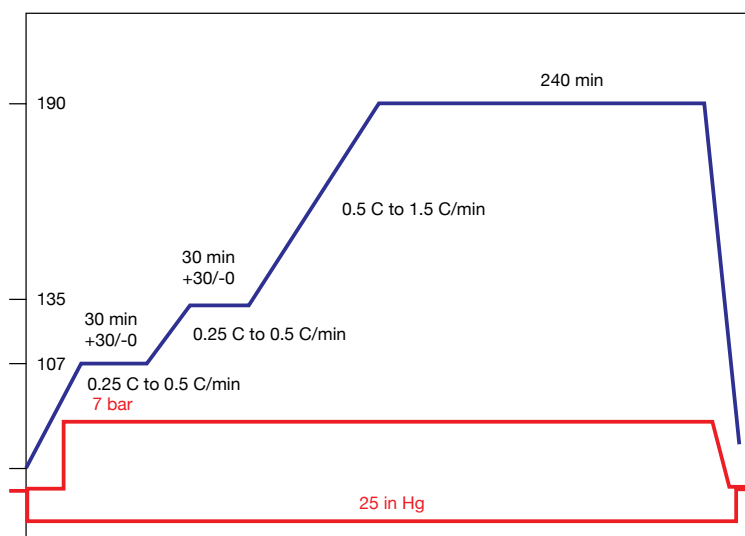
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Typical Autoclave Cure Cycle

Specific cure cycles [temperature, pressure (amount and application of)] depend on autoclave type and dimensions, the extent and type of tooling used and the size and complexity of the lay-up. Please contact your local Hexcel Technical Support for consultation prior to cycle definition. The following cycles are typical for HexTool® M61.

Low Temp Cure Cycle and Post Cure

Cure Cycle



- Part must be fully thermocoupled prior to the start of the cure cycle (ref. HexTool User Guide); deviations from recommended thermocoupling procedure or from recommended cure cycle may result in unacceptable part quality.
- Establish 25 in. Hg vacuum on part for minimum of 60 minutes.
- Heat part at 0.25-0.5°C/min to 107 °C (0.5-1.0°F/min to 225°F).
- When leading TC reaches 49°C +/- 2.5°C introduce 7 barr pressure at max of 0.65 barr/minute (120°F +/- 5°F introduce 100 psi pressure at a max of 10 psi/min).
- When lagging TC reaches 107°C +/- 2.5°C begin 30 minute soak (225°F +/- 5°F begin 30 minute +30/-0 min soak).
- Heat part at 0.25-0.5°C /min to 135°C (0.5-1.0°F/min to 275°F).
- When lagging TC reaches 135°C +/- 2.5°C begin 30 minute +30/-0 min soak (275°F +/- 5°F begin 30 min. +30/-0 minsoak).
- Heat part at 0.5-1.5°C/min to 190°C (1-3°F/min to 375°F).
- When lagging TC reaches 190°C +/- 2.5°C begin 240 minute soak (375°F +/- 5°F begin 240 min. +15/-0 minute soak).
- Cool part at maximum rate of 2.5°C/min to 66°C (5°F/min. to 150°F) before releasing pressure.

Free Standing Post Cure Cycle

- Heat up to 150°C (300°F) at 0.5°-2°C/min (1°-4°F/min)
- Heat up to 220°C (425°F) at 0.25°-1°C/min (0.5°-2°F/min)
- Hold at 220°C (425°F) for 16 hours
- Cool down at 0.5°C/min (1°F/min) to 150°C (300°F)
- Cool down at 1°C/min (2°F/min) to 60°C (140°F)



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Storage and Handling

Store the product in its original (or equivalent) sealed packaging at -18°C (0°F). Prevent condensation on the product by warming to room temperature before opening vapor barrier bag (reseal for subsequent storage). The usual precautions when handling uncured synthetic resins and fine fibrous materials should be observed, see Material Safety Data Sheet. The use of clean disposable impervious gloves provides protection for the operator and avoids contamination of material and components.

For more information

Hexcel is a leading worldwide supplier of composite materials to aerospace and industrial markets. Our comprehensive range includes:

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| • HexTow® carbon fibers | • HexFlow® RTM resins | • Acousti-CAP® sound attenuating honeycomb |
| • HexForce® reinforcements | • Redux® adhesives | • Engineered core |
| • HexPly® prepregs | • HexTOOL® tooling materials | • Engineered products |
| • HexMC® molding compounds | • HexWeb® honeycombs | |

For US quotes, orders and product information call toll-free 1-800-688-7734. For other worldwide sales office telephone numbers and a full address list, please go to:

<http://www.hexcel.com/contact/salesoffice>

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