

EP145 Epoxy Tooling Prepreg

EP145 is an ultra low temperature curing, high performance cost effective epoxy system. Capable of curing at 145° F, EP145 can display a Tg exceeding 350° F when suitably post cured. It is designed for high performance applications that require ultra low cure temperature or co-laminating with temperature sensitive materials and is available as a carbon and glass reinforced product configurations.

EP 145 allows high quality tooling laminates to be produced from low temperature master molds. This low temperature process offers the user a wide range of master mold materials. The user has the ability to use a low curing temperature/ oven or autoclave process for initial cure. The tool laminate then may be removed from the master mold for a free standing post cure. Autoclaved tools require no surface gel coat.

Features	Versatile curing profiles that range from 105°F for 40 hours to 350°F for 2 hours. Free standing post cure. Out life of 5 days at room temperature. Storage life of 6 months at 0°F. Good handling characteristics. Oven, bag or autoclave cured.
Fabrics	All EP 145 carbon prepregs are manufactured using balanced twill weave fabrics. Glass products are 7781 and 25 oz twill glass.
Thermal Stability	EP 145 resin is formulated to provide long term stability during normal 350°F service.
Low Shrinkage	Shrinkage of both the carbon and glass systems is very low. Combined with the varying cure cycles, a process is available to produce net molded tooling from numerous master molding materials.
Thermal Expansion	EP 145 tooling closely matches the thermal expansion of composite fabricated parts. This reduces dimensional inaccuracies and residual stress levels inherent in the use of other tooling materials and at the fraction of the cost of metal tooling.

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Tool Life EP 145 in a controlled lab environment has been successfully thermally cycled 200 times with no loss of vacuum integrity.

Vacuum Bagged When used with an epoxy gel coat laminated tools of extremely low void content can be produced. When using an autoclave curing process, the epoxy gel coat is not needed.

Technical Data for Glass Reinforced Tooling

Typical Results:	SP	BP
Tensile Strength, psi	43,000	75,000
Tensile Modulus, psi	3,000,000	3,600,000
Flexural Strength, psi	59,000	77,000
Flexural Modulus, psi	2,500,000	2,800,000
Short Beam Shear, psi	6,100	5,150
Tg	>350°F	>350°F

Technical Data for Carbon Reinforced Tooling

Typical Results:	SP	BP
Tensile Strength, psi	66,000	67,000
Tensile Modulus, psi	7,000,000	7,800,000
Flexural Strength, psi	80,000	70,000
Flexural Modulus, psi	5,000,000	5,900,000
Short Beam Shear, psi	5,150	5,400
Tg	>350°F	>350°F

Note: Test laminates were prepared using vacuum bag in an oven cycle with post cure.

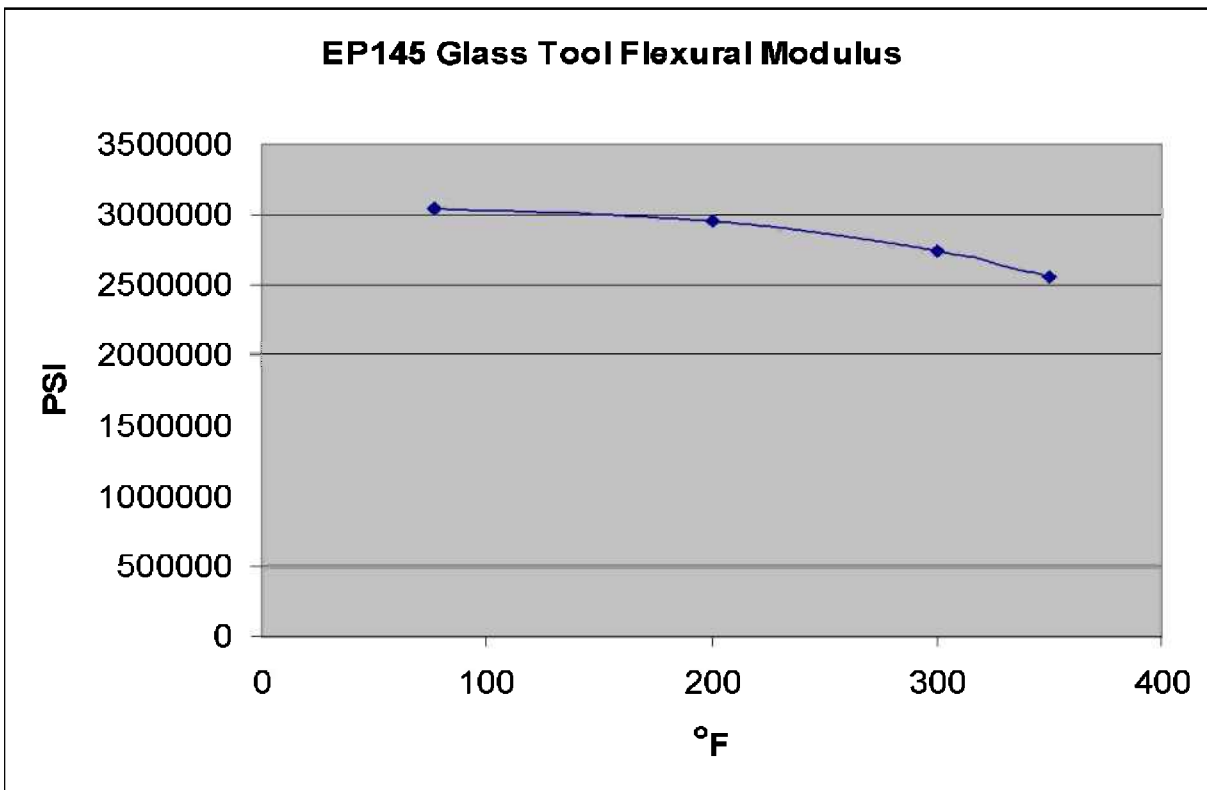
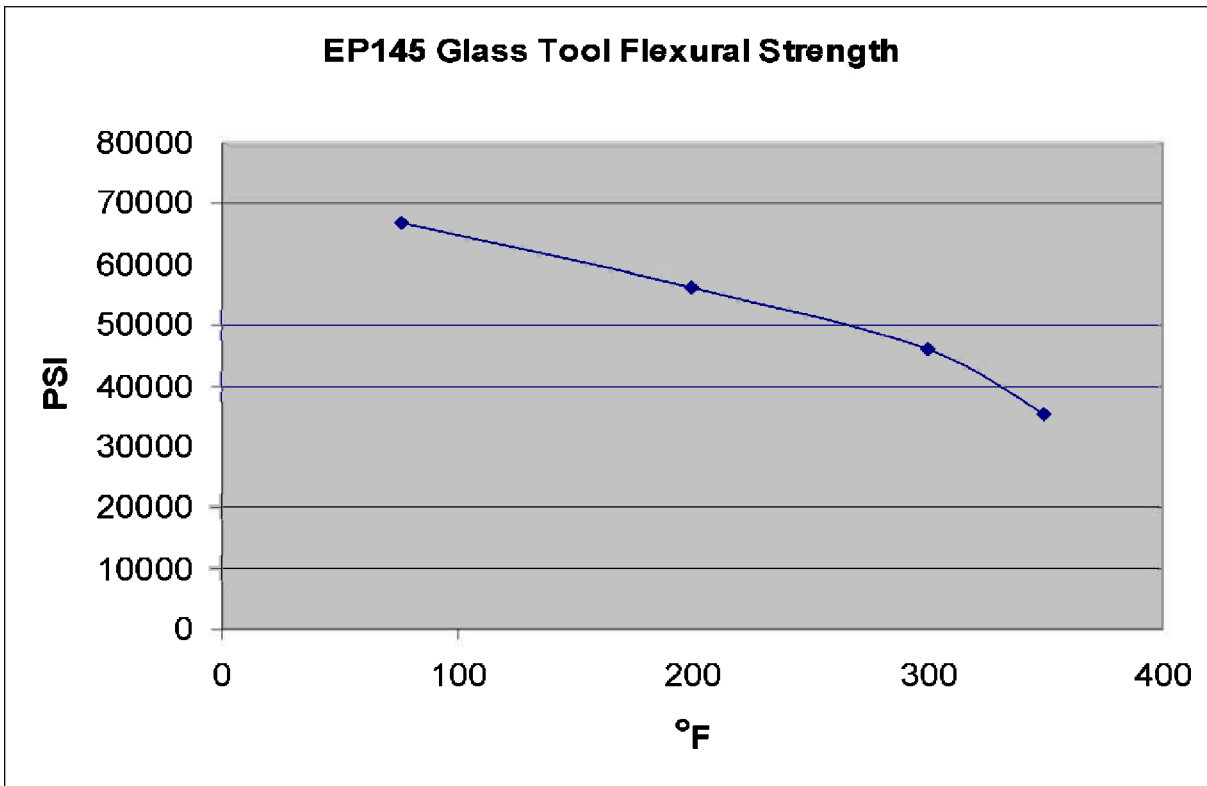
SP = Surface ply (7781 for glass, 6 oz twill for carbon)

BP= Build ply (25 oz twill for glass, 12K twill for carbon)

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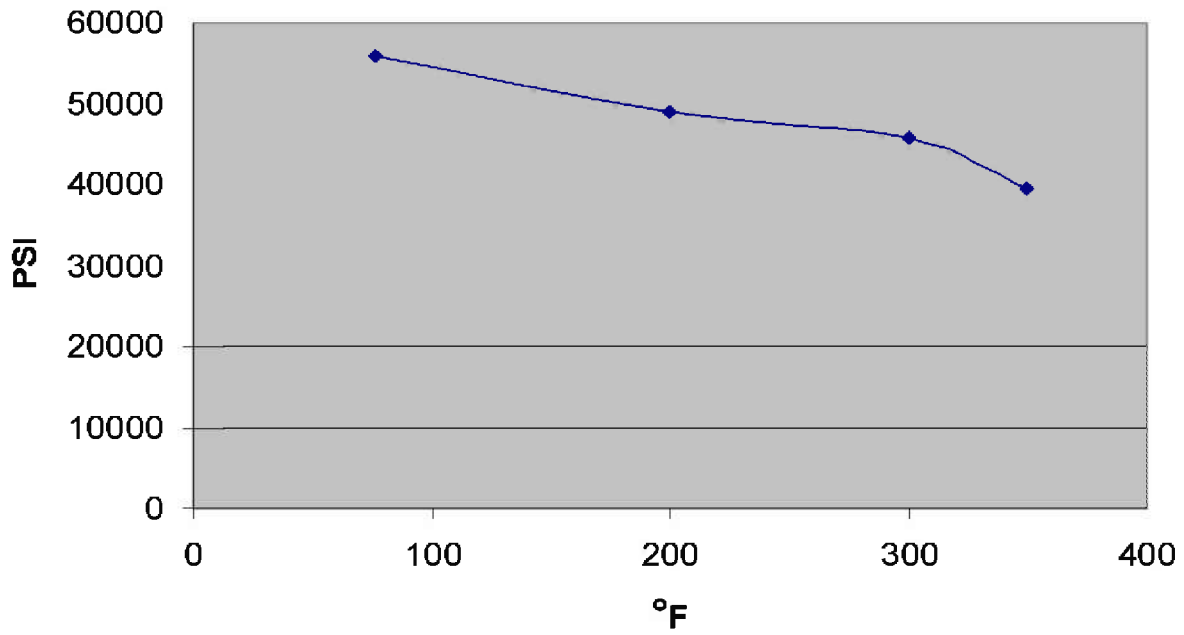
Elevated Temperature Performance



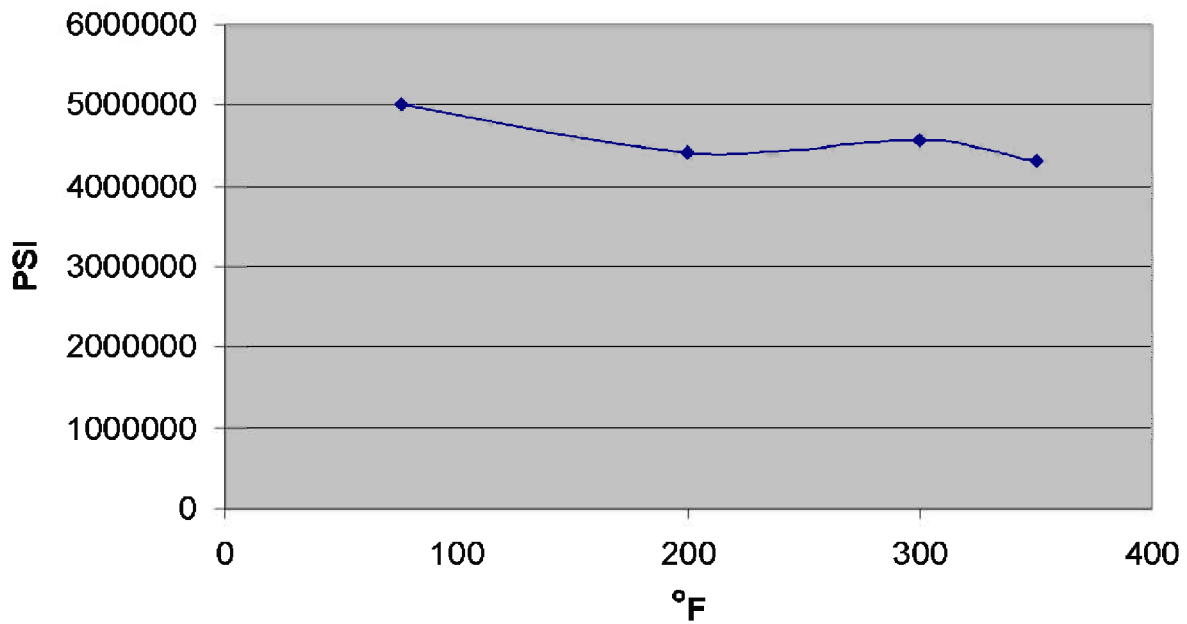
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EP145 Carbon Prepreg Tool Flexural Strength



EP145 Carbon Prepreg Tool Flexural Modulus



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Procedures for Autoclaved Prepreg Tooling

General Instructions

These procedures are recommended to fabricate a high quality laminated tool. Please contact Lewcott Corporation with questions regarding process changes.

Master Model Preparation

- Masters constructed from urethane or other foam masters must be sealed to prevent reaction to the prepreg. A suitable sealer should be used. Epoxy modeling boards or epoxy composite masters are preferred. Other master materials may be used but it is recommended that the fabricator contact Lewcott Corporation. Thoroughly dry plaster masters if used (24 hours minimum at 150°F). Master should be constructed so as to withstand the autoclave cycle. Solid models are preferred.
- Seal the surface of master model with epoxy surfacing resin. Polyester and other acid catalyzed surface coatings are not recommended for use with EP145 tooling prepreg. Some types of polyurethane sealers can cause an adverse reaction with the resin system, producing an unacceptable finish. Epoxy sealers are recommended.
- Thoroughly dry plaster masters if used (24 hours minimum at 150°F).
- Master should be constructed so as to withstand the autoclave cycle. Solid models are preferred.
- Thoroughly degrease the master model surface. Ensure all solvent is removed: this may require elevated temperature, then release with Frekote or another suitable release agent following the manufacturer's instructions.

Thawing Procedure

- Allow the prepreg rolls to warm to room temperature for one to two hours before opening the protective bag.
- Do not remove from freezer and leave out overnight. It is sufficient to wait until condensation is no longer visible on the outside of the bag

Lay-up Procedure

- Materials should be applied in accordance with Lewcott's recommended laminate schedule provided in this document. Other laminate schedules may be used with Lewcott's technical recommendations.
- Avoid any contaminants in the lay-up, such as paper, poly or release film, as these will have a negative effect on the tool laminate quality and may lead to tool failure prematurely.
- To avoid bridging, single pieces of prepreg should never be layed-up around more than one corner.

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Note: The tool must be finished and cured within the out life of the first ply of prepreg.

- Ensure enough material is available to complete the job. Scrap rates vary according to tool sizes but 10-15% should be sufficient for most tools.
- Apply the first ply of prepreg oriented at 0 degrees. The initial choice of which direction will be "0" is up to the individual laminator but once applied, all following plies must be measured using this data point.
- Use a 1.25" biased strip in all female radii.
- Overlap joints for first ply only should be a maximum of 0.25" and should be staggered.

Debulk Cycle

- Cover lay-up with a suitable perforated FEP release film or peel ply and ensure no bridging.
- Next apply a layer of 4 ounce breather fabric and cut to fit, so as not to cause bridging.
- Apply vacuum bag and pull a minimum of 25 inches of Hg vacuum and hold for 15 to 30 minutes depending on shop temperature.
- Remove vacuum bag and continue lay-up.

Note: Overnight debulks are only permissible after debulk number 2.

- Apply second ply at 0 degrees. On this and following plies butt jointing is preferable to overlapping.
- If butt joints are needed, joints must be staggered and shall not occur above one another.
- If overlapping is necessary, the overlap should be no more than 1".
- Continue the laminate schedule as suggested by Lewcott Corporation.
- Following debulks should be at plies 4 and 7 before final bagging procedure.

Final Bagging Procedure

- Place two or more thermocouples into the prepreg between ply 1 and 2 and between ply 9 and 10, situated near the thickest part of the master model and in a trim area.
- If secondary bonding to the tool laminate is required, apply a peel ply to the lay-up, ensuring there is no bridging.
- Cover lay-up with non perforated release film. Again ensure that there is not any bridging.
- Apply breather fabric (4 or 10 ounce). Do not bridge.
- Locate vacuum ports, on breather pads. Amount of vacuum ports depends on size of tool. Lewcott recommends one port for every 10 SF. Do not if possible locate vacuum ports on the laminate. Every attempt should be made to position them against the master model or in add on sleeves, ensuring they are connected to the breather fabric.
- Vacuum bag the lay-up using a high quality nylon film. Check for bridging.
- Check vacuum integrity. Pull a full vacuum (28" Hg) and disconnect the vacuum

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source. If bag pressure drops more than 2" Hg in 10 minutes check for and repair leaks.

Recommended Autoclave Cure Cycle

- Apply a minimum of 28" of Hg vacuum.
- Apply 80 to 100 psi autoclave pressure. It may be necessary to pressurize in stages to avoid overheating.
- Vacuum may be vented at 25 psi but is not always necessary.
- Ramp the heat at 1 to 3°F per minute.
- To promote an even heat up, do not allow autoclave temperature to exceed 10°F above the cure temperature.
- When the lagging thermocouple reads 145 to 150°F, hold for 16 hours.
- Cool under pressure to 100°F at 5°F per minute maximum.

Note: Please contact Lewcott Corporation for various cure alternatives.

Release Procedure

- Remove bagging from structure. If peel ply was used, remove only when necessary to allow backing structure attachment.
- Attach support structure if needed. Carefully release laminated tool from the master model. Always use soft plastic wedges. Metal tools should never be used.

Note: Do not trim the tool before post cure.

Post Cure Procedure

Post cure of the laminated tool is crucial to the long term stability and performance of the tool.

- Place the tool in an oven with thermocouples attached.
- Ramp rate of temperature should be 3°F per minute to 350°F.
- When lagging thermocouple reaches 340°F, start the 5 hour dwell.
- Cool at 5°F per minute to 150°F by lagging thermocouple.

Backing Structures

Most composite tools use some kind of support structure. There are different types of support structures and the system most suitable to the users' application should be used. Please contact Lewcott Corporation for more detailed information.

Tool in Service

- Before application of any release agent, the tool surface must be cleaned to remove all traces of mold release from the tool lay-up procedure. There are various methods to clean a composite tool. For more information on a cleaning procedure that would be for your work place, please contact Lewcott Corporation.
- After cleaning the tooling surface, it is recommended that the tool be sealed using a Chem Trend product such as Chemlease MPP117. This process will not

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