



LAMINATED EPOXY COMPOSITE PARTS USING ROOM TEMPERATURE VACUUM BAGGING TECHNIQUES



APPLICATION GUIDE

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SUGGESTED PROCEDURES FOR FABRICATION OF HIGH PERFORMANCE ROOM TEMPERATURE LAMINATED PARTS USING VACUUM BAGGING TECHNIQUES.

Demand for high strength light-weight composites is increasing and new markets categorized as "High Performance Consumer and Specialty Markets" are emerging on many levels. As an example, water enthusiasts are less than satisfied with 80 to 100 pound canoes. Sleek, high-tech-looking 30-40 pound canoes are gaining in popularity. Manufacturers of competition kayaks, canoes and power boats are constantly looking to reduce weight without sacrificing strength and durability. These composite products can be produced at high volume production levels using closed mold RTM processing methods. At lower volumes, less expensive and simplified open molds and vacuum bagging techniques or just hand laminating can be effective.

While this Application Guide focuses on room-temperature cure vacuum bagging techniques used to fabricate Epoxy/Kevlar® parts, the steps outlined apply to use of other fabrics. High temperature applications are also workable with the substitution of appropriate materials, laminating resins, and cure schedules. This procedure will produce close tolerance products with the optimum glass-to-resin weight ratios and strength-to-weight characteristics.

MATERIALS AND EQUIPMENT NEEDED:

- Vacuum pump capable of pulling vacuum at 26-29 inches of mercury
- Vacuum hose made of aramid fiber reinforced silicone rubber having a crush resistant stainless steel core.
- Bagging film; perforated release film; peel ply; bleeder/breather cloth; sealant tape; vacuum probe
- A qualified ADTECH resin system. (820 Marine, CER-112, EL-319, EL-320, EL-345, EL-346, EL-335, EL-350 and EL-355)
- Selected fabric
- Core stiffeners, if required

Note: Be sure to protect your vacuum pump and hose from inhaling catalyzed resin by adding additional layers of bleeder cloth/air weave under the vacuum probe

PROCEDURE:

1. Properly prepare your mold, model or pattern surface with a sealer, followed with several coats of an appropriate mold release agent to prevent adhesion.
 - Permeable model surfaces such as wood or plaster require the use of a sealer.
 - Polyester faced patterns or molds require sealer to prevent chemical leak through.
 - Epoxy or metal surfaces require only release agents to prevent adhesion.
 - Your model, pattern or mold must be capable of holding a vacuum (leak proof).
2. With your selected resin and fabric, hand laminate your part on the mold surface using a brush or plastic spreader to build the laminate to the required thickness.
3. After the laminate schedule is completed, prepare to bag. You must allow yourself enough time to bag and pull a vacuum (debulk) before your first laminate gels. If this requires stopping your laminating process, apply peel ply bleeder release to the last laminate and proceed to bag at full vacuum at room temperature. When the resin cures to a demoldable stage, remove bagging materials and peel ply, and resume laminate construction.

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4. Although vacuum bagging may look easy after watching the process, there are key points to keep in mind. Give yourself plenty of bagging in order to fill any deep contours. If pockets are too deep for the bag to depress properly, you will need to cast or machine a loose piece detail/insert that will nest against the shape of the laminate to intensify the vacuum pressure against the part. Inserts can be cast of epoxy, formed from epoxy tooling dough, elastomeric polyurethane, fast cast urethane, soft air weave formed to the shape of the pocket or machined model plank.
5. Debulk at full vacuum at room temperature.
 - If the bag does not place properly over laminate, break the seal and adjust the bag accordingly. Reseal the bag and pull vacuum to laminate. Repeat until bag placement is correct.
 - Be sure to completely cover laminate with release film to prohibit air weave from bonding to laminate. If air weave becomes resin rich, add a second or third layer until the top layer shows little resin.
6. When the resin cures to a demoldable stage you can remove the bag and demold the part. Refer to the specific Product Data Bulletin for the material that was used for the demold schedule.

SUMMARY:

1. ADVANTAGES:
 - High strength to weight ratios
 - Increased performance and durability
 - High tolerance parts (shrinkage <0.001 in/in)
 - Optimum glass to resin ratio
 - 30% weight reduction of parts
 - Minimal tooling cost
 - No styrene emission or VOC content
2. DISADVANTAGES:
 - Cost of aramid, graphite or E-glass fabrics greater than fiberglass mats.
 - Cost of epoxy resin greater than polyester or vinylester resin
3. Material references for production quality epoxy resin/hardener systems:
 - ProBuild Room Temp Laminating System
 - 820 Room Temp Laminating System
 - CER-112 Room Temp Laminating System
 - EL-335 High-Temp, High-Impact System
 - EL-319 Room Temp Flame Retardant System
 - EL-320 Room Temp Flame Retardant System

Note: Please carefully read and follow Product Data Bulletin instructions and Material Safety Data Sheet.