



GUIDE TO VACUUM FORM MOLDS

MATERIAL AND
APPLICATION TECHNIQUES

APPLICATION GUIDE

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VACUUM FORM MOLDS – GUIDE TO MATERIALS AND APPLICATION TECHNIQUES

Mold Making Materials For All Vacuum Form Processes/Methods: Straight Vacuum Forming
Drape Forming - Snapback Vacuum Forming – Drape Vacuum Forming – Plug Assist
Billow Air-Slip Vacuum Forming - Billow Drape Vacuum Forming – Billow/Plug Assist/Snapback

SMALL PROTOTYPE VACUUM MOLDS

Small prototype vacuum molds of 4 square feet or less used for prototype or low volume production can be solid cast with LUC-4105 Fast Cast Urethane. A big advantage in using LUC-4105 is the quick curing characteristics of the materials. With this system it is possible, once the mold is poured, to machine and drill the mold following a 2-hour room temperature cure. This system does not require a post cure prior to using as the cured materials will withstand intermittent exposures to 285°F -320°F. It also has excellent duplicating features and can be poured in thicknesses up to ten inches.

1. Construct a plywood frame around pattern/model to contain casting and seal all joints to prevent resin leaks. Apply mold release per manufacturers' instructions (Mold Release MR #1) to pattern/model and plywood containment.
2. Thoroughly mix A and B components individually to re-suspend settled fillers prior to mixing the A and B components together. Using a Jiffy baffle mixer thoroughly mix A and B together until color striations disappear, generally 45-60 seconds of mixing, and immediately pour into model cavity.
3. Once the material is allowed to cure and harden for approximately 60-90 minutes it can be removed from the model, vacuum holes drilled (vacuum holes should be a maximum 3 inches apart) and mounted to a vacuum table or platen.
4. Condition mold surface with Mold Sealer MR #7 and Mold Release MR #10.

SMALL PRODUCTION VACUUM MOLDS

Small production vacuum molds of 4 square feet or less used for production can be solid cast or shell cast with EC-433 High-Temp Aluminum Filled Epoxy Casting System.

1. Construct a plywood frame around pattern/model to contain casting and seal all joints to prevent resin leaks. Apply mold release per manufacturers' instructions (Mold Release MR #1) to pattern/model and plywood containment.
2. Thoroughly mix EC-433 High Temp Mass Casting System (with 3 hardener options) and before casting generously brush a slurry coat on the pattern/model to relieve surface tension and prevent pinhole porosity on your cast mold surface. Immediately pour remaining catalyzed material into model cavity.
3. Cure EC-433 for 24 hours at room temperature plus 3 hours at 150°F before removing from the model and drilling the vacuum holes. Vacuum holes should be a maximum 3 inches apart. Mount tool to a vacuum table or platen. The final cure will take place during the intermittent vacuum forming operations or follow the recommended cure cycle on the product bulletin to 200°F.
4. Condition mold surface with Mold Sealer MR#7 and Mold Release MR#10.

Note: For optimum cooling efficiency of molds that will cycle high volumes on a daily basis add aluminum bulk filler when casting tool: N-20 Aluminum Grain is recommended. When using aluminum grain additives in casting resin it is necessary to surface coat the pattern/model with two 0.015"-0.020" coats of ES-229 High-Temp Aluminum Filled Epoxy Surface Coat Surface before casting.

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LARGE LAMINATED PRODUCTION VACUUM MOLDS

When the surface area exceeds four square feet it becomes more economical to consider laminating a composite mold.

1. Apply mold release to pattern/model per manufacturers' instructions (Mold Release MR #1).
2. Catalyze ES-229 High Temp Surface Coat and brush coat a 0.015"-0.020" thickness over pattern/model surface and allow to tack.
3. During the tack stage of the first surface coat, brush apply a second coat of catalyzed ES-229 at a thickness of 0.015"-0.020".
4. When the second coat of ES-229 reaches tack stage be prepared to immediately apply a catalyzed coating of EL-337 High Temp Laminating Resin and begin to laminate 6 plies of Style #7500 10oz Fiberglass Cloth. Note: The application of dry cloth onto a pre-wet surface with a stipple brush or spatula will draw the laminating resin and air up through the cloth, wetting out the cloth and releasing air. After laminating 6 plies Style #7500 10oz Fiberglass Cloth you can begin laminating with Style #7587 20oz Fiberglass Cloth to build laminate thickness quicker. Total laminate thickness of a large vacuum forming mold is generally ½ inch (0.50").
5. When EL-337 laminate is cured and demolded (see data bulletin for instructions), composite air evacuation chambers can be built into the back of the mold under drill points. Half-round Styrofoam is tacked in place at strategic air evacuation points and routed to a central manifold connection point. After the Styrofoam is tacked in place sand a 1" - 1-½" bonding surface on the Styrofoam. Fiberglass in these half-round shapes with 6 plies of Style #7500 10oz Fiberglass Cloth and EL-337. When the laminate is cured, wash out the Styrofoam with lacquer thinner or acetone to form the air evacuation chambers. Air holes can then be drilled through the mold face and into the chamber.
6. Attach steel substructure frame.
7. Condition mold surface with Mold Sealer MR #7 and Mold Release MR #10.

ECONOMICAL LAMINATED/SYNTACTIC EPOXY PRODUCTION VACUUM MOLDS

The use of EL-325-HTTC High Temperature Epoxy Tooling Compound, a syntactic dough type material, can be used to minimize labor by quickly building mold thickness and eliminating numerous plies of fiberglass cloth. The time and materials required to construct/fabricate a high strength production mold is reduced due to the ease with which a mold can be constructed.

1. Apply mold release to pattern/model per manufacturers' instructions (Mold Release MR #1).
2. Catalyze ES-229 High Temp Surface Coat and brush coat a 0.015"-0.020" thickness over pattern/model surface.
3. During the tack stage of the first surface coat, brush apply a second coat of catalyzed ES-229 at a thickness of 0.015"-0.020".
4. When second coat of ES-229 reaches tack stage be prepared to immediately apply a catalyzed coating of EL-337 High Temp Laminating Resin and begin to laminate 3 plies of Style #7500 10oz Fiberglass Cloth. Note: The application of dry cloth onto a pre-wet surface with a stipple brush or spatula will draw the laminating resin and air up through the cloth, wetting out the cloth and releasing air.
5. Once the 3 ply laminate has reached a near tack stage, create a bond coat (slurry coat) by blending a 1:1 mixture of pre-catalyzed EL-337 Laminating Resin with an equal amount of pre-catalyzed EL-325 HTTC Tooling Compound. Thoroughly mix these two together to form a slurry mixture. Brush apply this bond coat to the EL-337 laminate during its tack stage (you must maintain a chemical bond) at a thickness of about 0.030".
6. Thoroughly mix EL-325-HTTC Tooling Compound and immediately proceed to apply it to the laminate (while the bond coat is still wet) at a thickness of 1/2" - 5/8". Once the EL-325 is applied, allow to firm up and apply a wet layer of EL-337 Laminating Resin to the entire surface. Continue to apply the equalizing 3 layers of laminated fiberglass to the mold. Allow to set 8-12 hours prior to adding egg crating to create the vacuum chamber. Follow the previously described methods for attaching to the backing board or plate.

NOTE: Mixing large batches of EL-325-HTTC is best achieved with a portable KOHL type mixer (a motor driven mixer that rotates a 5-gallon pail around a stationary "J" hook that can mix batch sizes of 3-4 gallons).

NOTE: In order to maintain a uniform Tooling Compound thickness construct a board that is 3 to 4 feet in length and 12"-18" wide. Mount 1/2"-5/8" thick shims strips along both sides of the board. Place industrial wax paper on top of the board and shims. Lay the mixed tooling compound on the paper. Lay another sheet of industrial wax paper on top of the tooling compound. Use a 4" diameter PVC pipe to roll and compress the tooling compound to the desired thickness. Use a knife or paint paddle to slice the compound into 8"-12" squares and a spatula to make handling easier. These squares are then applied (decal method) to the still wet bond coat, firmly butting each piece against the previous one applied. Take care to insure that air is not entrapped between the tooling compound and the laminate. Once the entire laminate is covered with tooling compound, use a roller to apply moderate pressure to compact butted sections into a seamless surface.

7. Allow the tooling compound to firm up 1-½ - 2 hours. At this time coat the entire compound surface with catalyzed EL-337 and laminate 3 plies of 7500 style 10oz fiberglass cloth. The plies of fiberglass cloth on the back of the tooling compound must always equal the number of plies laminated in step #4.
8. When mold is cured and demolded (see data bulletin for instructions), composite air evacuation chambers can be built into the back of the mold under drill points. Half-round Styrofoam is tacked in place at strategic air evacuation points and routed to a central manifold connection point. After the Styrofoam is tacked in place sand a 1 - 1-½" bonding surface on both of the Styrofoam. Fiberglass in these half-round shapes with 6 plies of Style #7500 10oz Fiberglass Cloth and EL-337. When the laminate is cured, wash out the Styrofoam with lacquer thinner or acetone to form the air evacuation chambers. Air holes can then be drilled through the mold face and into the chamber.
9. Attach a steel substructure frame.
10. Condition mold surface with Mold Sealer MR #7 and Mold Release MR #10.

CNC MACHINED PRODUCTION VACUUM MOLDS

The use of CNC machined Tooling Planks for production vacuum form molds eliminates the need to construct a pattern/model and minimizes time and labor. Which Tooling Plank to use will depend on temperature and substrate being formed. DP-1051 Die Plank and MP-1075 Mid-Temp Model Plank are two Tooling Planks used for vacuum forming (see product bulletins for more information).

1. Purchase plank size that meets the dimensional requirements of the part being formed; allowing for flange width requirements and 1.00" minimum mold wall thickness.
2. If it is necessary to bond planks together make sure the bonding surface is free of contaminants before applying adhesive; sand off shiny surfaces; blow off sanding dust. Use EL-337 or EL-336 High Temp Laminating Resin to bond planks; clamp together and cure 24 hours at room temperature (OR) 2 hours at room temperature + 2 hours @ 125°F + 2 hours @ 150°F.
2. CNC machine (see product data bulletin for machining instructions); polish; drill vacuum holes; mount to vacuum table or platen; condition mold surface with Mold Sealer MR #7 and Mold Release MR #10.

PLEASE REFERENCE PRODUCT DATA BULLETINS

HIGH-TEMP SURFACE COAT: ES-229 / ES-225 / ES-219

HIGH-TEMP TOOLING COMPOUND: EL-325-HTTC / EL-325-1 HTTC

HIGH-TEMP CASTING SYSTEM: EC-433 Resin with 3 hardener options

FAST-CAST URETHANE: LUC-4105 / LUC-4102

MOLD RELEASE: Mold Release MR #1 / Mold Sealer MR #7 / Mold Release MR #10

N-20 (-6+20 mesh) ALUMINUM GRANULE

E-GLASS PLAIN WEAVE FIBERGLASS CLOTH: Style #7533 6oz / Style #7500 10oz / Style #7587 20oz

CNC PLANKS: DP-1051 Die Plank / MP-1075 Intermediate Temp Model Plank