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## Composite Sandwich Tool Construction

### Recommendations for the use of EL-323-TC and EL-325-HTTC Epoxy Tooling Compounds

Please Read these Recommendations to completion before proceeding  
 Recommended thicknesses are in table below

- 1) Properly prepare the mold, model or pattern surface with a sealer followed with several coats of an appropriate mold release and parting agent.
  - (a) Permeable model surfaces such as wood or plaster require a sealer. Polyester faced patterns or molds also need a sealer to prevent chemical leak through.
  - (b) Epoxy or metal surfaces require only release agents or parting agents.
- 2) Catalyze and mix Surface Coat by weight according to Ratio on Containers. Apply Surface Coat to the model surface with a brush or spatula. Care should be taken to apply the first layer of surface coat in only one direction to reduce the pick-up of mold release into the surface coat creating surface defects needing repair. This surface coat layer should be at the recommended thickness. Allow the surface coat to Tack at Room Temperature. "Tack" is being able leave your fingerprint without much material adhering to the finger. Note: Allowing previous coat to go beyond tack can allow delamination.
- 3) Apply a 2<sup>nd</sup> coat at the recommended thickness of the surface coat when the 1<sup>st</sup> coat is to tack.
- 4) Begin laminating when the 2<sup>nd</sup> surface coat is to tack. Catalyze and mix Laminating resin according to the ratio on the container. With a brush, thoroughly cover the almost tacky back of the Surface Coat. Begin applying 10oz. style fiberglass laminating cloth. For best results use a brush or laminating roller to gently push cloth into the laminate resin. Make sure the cloth is fully saturated with resin and no air is entrapped behind the cloth. Stippling with a Natural Bristle Brush, having cut the bristles back to 3/4", is an efficient method of wetting the cloth thoroughly, forcing the air to escape from the laminate. Apply a total of 3 layers of laminate using the laminating resin as needed.
  - a) Do not use laminating resin to excess, there should be no areas where pooling of resin occurs. If pooling occurs, move the excess to a dryer area in the laminate or discard the excess Laminating System.
  - b) To prevent air entrapment under the cloth, butt the cloth together when laminating a sharp female radius. Stippling to remove any air entrapments is recommended.

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- c) The dimensional stability and strength of a mold will be maximized by alternating or angling the direction of each laminate layer ( $0^\circ$ ; plus  $45^\circ$  from zero; minus  $45^\circ$  from zero). For high temperature laminates vacuum consolidation of the laminate layers will result in a lighter, leaner tool, and reduce the chance of air entrapment.
- 5) When lamination begins to firm up, mix up a bond coat. The bond coat consists of catalyzed laminating resin and catalyzed tooling compound combined 1:1 by volume and blended to a smooth consistency. Apply this bond coat to the firm but tacky laminate surface with a brush.
  - a) This bond coat will create a strong chemical bond between the laminate surface and the tooling compound and also allows for easy application of tooling compound to the surface.
  - b) It is important that the bond coat is still wet when applying the tooling compound.
  - c) Apply bond coat between 60 and 80 Mills (0.060 – 0.080 in., 1.5 – 2.0mm) in thickness.
- 6) Immediately mix Tooling compound by weight according to the technical data sheet, referring to the mix ratio on the container. The tooling compound has been formulated with a color-coded mix indicator, as the Resin & Catalyst are of different colors. Mix until the blended color is consistent, without streaks.
  - a) Hand mixing is adequate for small volumes, but for large volume and/or frequent use projects, a mechanical dough type mixer is more practical and cost/labor efficient.
- 7) In order to maintain a uniform tooling compound thickness on the mold or part you should have previously constructed a board 3-4 feet in length and 12-18 inches in width. Mount  $3/8$  inch shims along both sides of the board. Place industrial wax paper on the board and lay in the mixed tooling compound. Lay a second sheet of industrial wax paper on top of the tooling compound and use a 4-inch diameter pvc pipe to roll the tooling compound to a  $3/8$ -inch thickness. Remove the wax paper and cut the tooling compound into 8-12 inch squares. Apply these squares to the still wet bond coat. Take care to avoid air entrapment between the tooling compound and the laminate. (Note: Plastic sheeting can be used in place of waxed paper, cut the plastic sheet and mixed dough, then transfer to the tool build where the plastic sheeting is removed at application)

An alternate method of applying the tooling compound when uniform thickness is not important is to take the tooling compound straight from the mixer, form it to a softball size and pack it on the still wet bond coat. Each successive formed ball should be pushed into the inside leading edge of the previously applied material causing the tooling compound to mushroom and spread out over the surface while completely pushing out any air. This is the most effective, least labor intensive and quickest method of application. Tooling compound thickness can still be kept uniformly close to  $3/8$  inches. Pinch edges of the dough together and pat lightly to remove seams and avoid trapping air in the dough.

- 8) After the entire surface has been covered with tooling compound, allow it to firm up (about an hour), then repeat step 5 on the back of the tooling compound.
- 9) Making sure the bond coat is still wet, coat the entire surface with the laminating resin used earlier and begin to laminate a final 3 layers of 10oz cloth. **The number of layers on the back of the tooling compound must always equal the number of layers first applied in step 4. This affords a balanced lamination,**

maximizing the integrity of the sandwich tool construction. If vacuum consolidation was used in step 4c, it should be repeated here for the last laminate layers.

10) Allow the entire tool to cure overnight at room temperature prior to attaching any support structures. Premature attachment of support structures to epoxy or polyester laminate molds can cause tool warpage.

11) Schedules Below.

Tooling Compound	<b><u>EL-323-TC</u></b>		<b><u>EL-325-HTTC</u></b>	
Surface Coat (face of tool)	ES-218	20-30 mils/layer (0.020-0.030 in., 0.51 – 0.76mm)	ES-229	15-20 mils/layer (0.015-0.020 in., 0.38 – 0.51mm)
Laminating Resin	EL-302-PC	3 layers Fiberglass	EL-337	3 layers Fiberglass
Bond (slurry) coat (1 to 1 by volume blend of mixed laminating resin and mixed syntactic paste)		60 and 80 Mils (0.060 – 0.080 in., 1.5 – 2.0mm)		60 and 80 Mils (0.060 – 0.080 in., 1.5 – 2.0mm)
Syntactic Paste	EL-323-TC	3/8"-3/4" thickness (10-20mm)	EL-325-HTTC	3/8"-3/4" thickness (10-20mm)
Bond (slurry) coat (1 to 1 by volume blend of mixed laminating resin and mixed syntactic paste)		60 and 80 Mils (0.060 – 0.080 in., 1.5 – 2.0mm)		60 and 80 Mils (0.060 – 0.080 in., 1.5 – 2.0mm)
Laminating Resin	EL-302-PC	3 layers Fiberglass	EL-337	3 layers Fiberglass



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EL-323TC

Area of Tool, square feet

				Thickness	1	5	10	50	100	1,000	
Top (backside) Laminate	EL-302PC	3 plies		0.0625	0.46	2.28	4.55	22.77	45.55	455.45	
Slurry Coat	1/1 by vol. mixed EL-302PC/EL-323TC	thickness		0.06	0.37	1.82	3.63	18.14	36.28	362.81	
Tooling Compound	EL-323TC	thickness		0.5	1.79	8.96	17.92	89.61	179.22	1,792.21	
Slurry Coat	1/1 by vol. mixed EL-302PC/EL-323TC	thickness		0.06	0.37	1.82	3.63	18.14	36.28	362.81	
Laminate	EL-302PC	3 plies		0.0625	0.46	2.28	4.55	22.77	45.55	455.45	
Face (surface coat)	ES-218	2 coats		0.03	0.48	2.38	4.75	23.77	47.53	475.32	
ES-218 total pounds						0.48	2.38	4.75	23.77	47.53	475.32
EL-302PC total pounds						1.40	6.94	13.86	69.30	138.60	1,385.92
EL-323TC total pounds						2.05	10.22	20.42	102.13	204.28	2,042.81

EL-325HTTC

Area of Tool, square feet

				Thickness	1	5	10	50	100	1,000	
Top (backside) Laminate	EL-337	3 plies		0.0625	0.41	2.05	4.10	20.49	40.99	409.87	
Slurry coat	1/1 by vol. mixed EL-337/EL-325HTTC	thickness		0.06	0.34	1.72	3.43	17.15	34.32	343.17	
Tooling Compound	EL-325HTTC	thickness		0.5	1.65	8.24	16.49	82.44	164.88	1,648.83	
Slurry coat	1/1 by vol. mixed EL-337/EL-325HTTC	thickness		0.06	0.34	1.72	3.43	17.15	34.32	343.17	
Laminate	EL-337	3 plies		0.0625	0.41	2.05	4.10	20.49	40.99	409.87	
Face (surface coat)	ES-229	thickness		0.03	0.52	2.59	5.18	25.91	51.82	518.18	
ES-229 total pounds						0.52	2.59	5.18	25.91	51.82	518.18
EL-337 total pounds						1.28	6.40	12.78	63.88	127.80	1,277.92
EL-325HTTC total pounds						1.87	9.38	18.77	93.84	187.70	1,876.99