ROOM TEMPERATURE PLASTIC TOOLING

OVERVIEW

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FABRICATION METHODS OF ROOM TEMPERATURE PLASTIC TOOLING

TRADITIONAL LAMINATE

One of the more popular fabrication styles that will produce dimensionally accurate tools light in weight and low in material cost.

1. Properly prepare your model or pattern surface with several coats of an appropriate mold release and a coat of parting agent (if preferred) over the mold release such as Mold Release MR #1 and MR #2.
   - Permeable model surfaces such as wood or plaster require the use of a sealer. Polyester and vinylester faced patterns or molds also require a sealer to prevent chemical leak through.
   - Epoxy or metal surfaces require only release agents and a coat of parting agent applied over the mold release (if preferred).

2. Brush on a .020" - .030" layer of Epoxy Surface Coat that is properly catalyze and thoroughly mixed. Allow to tack.
   - Customer preference may be to apply a single surface coat layer of .060", however applying a single coating at this thickness could result in pinholes on the surface of the mold.
   - Tack refers to a curing phase of the resin as follows: the resin will not stick to your finger when touched, but is soft enough to leave a fingerprint.

3. When the surface coat has reached the tack stage you may begin laminating.
   - Catalyze and mix the Epoxy Laminating Resin by weight according to the Data Sheet instructions.
   - Begin applying Style #7500 10oz Fiberglass Cloth using a brush or laminating roller to gently compact the cloth into the laminating resin, wicking the resin up through the fabric.
   - Make sure the cloth is fully saturated with resin and no air is entrapped between the cloth and surface coat.
   - Continue to apply additional layers of fabric, applying laminating resin as needed until the desired laminate thickness has been reached.
   - A finished laminate will range from ¼" to ½" in thickness depending on the physical demands of the finished tool. This is approximately 16 – 48 plies of Style #7500 10oz Fiberglass Cloth.
   - If you prefer to laminate with heavier Style #7587 20oz Fiberglass Cloth it is best to first use 3 – 4 plies of Style #7500 10oz Cloth against the surface coat to prevent print through from the heavier 20oz weave.
   - Do not apply laminating resin to excess. There should be no areas where pooling of resin occurs.
   - Butt the cloth together when laminating a sharp female radius to prevent air entrapment under the cloth.

4. Allow finished laminate to cure on the model before attaching a support structure to the back of the laminated tool with laminating resin and fiberglass cloth.
   - When bonding against a cured laminate it is necessary to abrade the surface with coarse sandpaper. Commonly used substructure materials are fiberglass tubing, honeycomb panels, composite base stock, plywood or metal tubing.

5. Allow support structure bonds to cure before demolding tool from model or pattern.

TRADITIONAL LAMINATE WITH SYNTACTIC EPOXY CORE

This method has gained much favor over traditional laminates. This fabrication style will reduce time, labor and material cost compared to traditional laminates, and dimensional accuracy and tool rigidity will be improved.

- See Application Guide "Room Temperature Duplication Aids".

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SOLID CAST

This is the easiest by far of all fabrication styles. It requires nothing more than building a leak-proof containment box (plywood frame) around a model or pattern, constructing it to a height required for tool design, and pouring catalyzed casting resin against the model surface.

- Solid cast resins will have casting thickness limitations due to chemical exotherms (heat generated during chemical reactions) which will result in excessive shrinkage if overlooked. Always refer to casting thickness limits published on Product Data Bulletins. Casting thickness limits can be exceeded using Bulk Fill techniques.

Abbreviated Construction Sequence

1. Properly prepare your mold, model or pattern (refer to Traditional Laminates Section 1 above).

2. Construct and attach a container box strong enough to support the weight of the cast without deflection. Cross bracing may be required.

3. Seal joints between the model and box to prevent leaks. The use of modeling clay or ADTECH Filler Paste P-26 will suffice.

4. Apply two coats of ADTECH Mold Release MR #2 parting agent to the inside of containment walls to prevent bonding.

5. Catalyze the casting resin and pour it slowly into the lowest points of the cavity until filled.

6. Allow to cure on the model. Refer to the Product Data Bulletin of the casting resin for cure schedules.

7. Machine the back of mold to achieve parallel fit and demold from the model.

SURFACE CAST

Similar to solid casting with the exception that a solid pre-cast core is used to form the largest mass of the finished tool (i.e. Cast Polymer Cement Core or Cast Kirksite Metal Alloy Core). This core is made 3/8" to 1/2" smaller in dimension than the finished tool size. The core is suspended over the model surface using the side containment box walls as support, maintaining a 3/8" to 1/2" gap between the model surface and core, and the containment walls and core. This gap is then filled with the selected casting resin and allowed to cure. See Product Data Bulletin of the casting resin used for cure schedule.

- This surface casting method is very effective when constructing larger tools for metal forming.

Abbreviated Construction Sequence

1. Properly prepare the model, mold or pattern (refer to Traditional Laminates Section 1 above).

2. Construct and attach a containment box (plywood frame) strong enough to support the weight of the core and casting resin without deflection; cross bracing may be required.

3. Seal joints between the model and box to prevent leaks. The use of modeling clay or ADTECH Filler Paste P-26 will suffice.

4. Apply two coats of ADTECH Mold Release MR #2 parting agent to the inside containment walls to prevent bonding.

5. Suspend the pre-cast core inside the cavity using the side containment walls for support. Maintain a 3/8" to 1/2" gap between all five surfaces. Kirksite is a common metallic alloy used to produce core castings.

6. Catalyze the casting resin and slowly pour into the lowest point of the cavity until filled.

7. Allow to cure on the model. Refer to the Product Data Bulletin of the casting resin used for cure schedules.

8. Machine the back of the mold to achieve a parallel fit and demold from the model.

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AREAS OF APPLICATION FOR ROOM TEMP PLASTIC TOOLING

DUPLICATING AID

Just as the name implies, a mold is made from an existing master model or part. This mold will become a negative mirror image of that master model or part and will be used to make another mold off its surface which will have a positive mirror image of the original master model or part.

Methods of Fabrication

1. **Traditional Laminate**
   - Surface Coat Options: ES-201PC / ES-204 / ES-204-SC / ES-218
   - Laminating Resin Options: EL-301 / EL-302-PC
2. **Traditional Laminate with Syntactic Epoxy Core**
   - Surface Coat Options: ES-201PC / ES-204 / ES-204-SC / ES-218
   - Laminating Resin Options: EL-301 / EL-302-PC
   - Syntactic Epoxy: EL-323-TC
3. **Solid Cast - A practical application for duplicating aids up to 4 sq. ft.**
   - Surface Coat Options: Not Required
   - Casting Resin Options: EC-428 / EC-428-1 / LUC-4101 / LUC-4102 / LUC-4105

JIGS AND FIXTURES

Used to position or hold parts for trimming, drilling, assembly, or quality control checks.

Methods of Fabrication

1. **Traditional Laminate**
   - Surface Coat Options: ES-201PC / ES-204 / ES-204-SC / ES-218
   - Laminating Resin Options: EL-301 / EL-302-PC
2. **Traditional Laminate with Syntactic Epoxy Core**
   - Surface Coat Options: ES-201PC / ES-204 / ES-204-SC / ES-218
   - Laminating Resin Options: EL-301 / EL-302-PC
   - Syntactic Epoxy: EL-323-TC
3. **Solid Cast - A practical application for duplicating aids up to 4 sq. ft.**
   - Surface Coat Options: Not Required
   - Casting Resin Options: EC-428 / EC-428-1 / LUC-4101 / LUC-4102 / LUC-4105
4. **Surface Cast - Used as a surface for steel holding or nesting arms.**
   - Casting Resin Options: EC-426 / EC-428/ LUC-4101 / LUC-4102 / LUC-4105

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OPEN MOLDS/CLOSED MOLDS

Used to produce laminated or cast prototype and low volume production parts. An open mold is a one piece mold (male or female) in which a part is laminated. A closed mold is a two piece mold (male and female) in which parts are cast. This technique requires a sprue (pour hole) and air vent holes on the backside of the female mold. Casting resin is fed in through the sprue using gravity or mechanical pressure.

Methods of Fabrication

1. Traditional Laminate

- Surface Coat Options: ES-201PC / ES-220
- Laminating Resins Options: EL-301 / EL-302PC

2. Traditional Laminate with Syntactic Epoxy Core

- Surface Coat Options: ES-201PC / ES-204 / ES-204-SC / ES-218
- Laminating Resin Options: EL-301 / EL-302-PC
- Syntactic Epoxy: EL-323-TC

3. Solid Cast

- Casting Resin Options: EC-428/EC-428-1/LUC-4101/LUC-4102/LUC-4105/ Flexible Casting Resin (See the Product Catalog for Elastomeric Urethanes).

METAL FORMING

This is considered the most demanding of all room temperature Epoxy Tooling applications. There are three primary methods for forming sheet metal.

1. Stretch Block Forming

- Required in the aircraft industry to form contoured metal shapes for prototype and production. This is accomplished with a one piece male tool. The metal is stretched and pulled downward against the tool surface to form the final shape.

2. Drop Hammer Forming

- Used in the aircraft industry to literally bang out metal shapes for both prototype and production requirements. This is accomplished with a two piece tool (male/punch and female/die). The sheet metal rests on the die. The punch is suspended above with 2-4 tons of weight behind it, and is dropped, forcing the metal into the shape of the die.

3. Draw Die Forming

- Primarily used in the automotive industry for forming prototype sheet metal parts (hoods, fenders, roofs etc.) This tooling consists of a three piece mold (male/punch, female/die and binder ring/draw ring). The processes used for this type of forming are Hydraulic or Toggle (mechanical). To form the part, sheet metal is nested on the die and locked in place with the binder ring using cushion pressure (upper press platen). The punch is then brought down through the cushion using RAM pressure, stretching and forming the metal to the shape of the die.
- A two piece punch and die tool is sometime adequate for forming sheet metal in automotive prototype applications. Much depends on the quality of parts considered acceptable by the customer. Sheet metal thickness should be kept under .060" for best results with epoxy tooling.

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Methods of Fabrication

1. **Traditional Laminate** - Stretch blocks only

   - Surface Coat Options: ES-204 / ES-204-SC

   - Laminating Resin: EL-301 / EL-302-PC
     Note: A laminate support cast substructure is required. This is made of a Polymer Cement mixture using as an example (5) 50 lb. bags of coarse dry silica sand and (1) 5 gallon unit of catalyzed EC-426.

2. **Solid Cast** - Acceptable for all three metal forming methods. However, there are casting thickness limitations.

   - Casting Resin Options: EC-426-2

3. **Surface Cast** - Acceptable for all three metal forming methods. This style of tooling will be the most versatile, durable and dimensionally stable. Refer to "SURFACE CAST" above for instructions.

   - Surface Casting Resin Options: EC-426

MASTER MODELS

These are used as a permanent or temporary three dimensional reference to a finished part surface. For example, a master model is built in the shape of what will eventually be the outer surface of a nose cone or automotive fender. These master models will be used as a three dimensional reference and to produce (duplicate) the prototype parts.