



# Rapid tooling system, the effective way to make a perfect mold

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The surface quality of a mold is a decisive factor for obtaining a high-quality surface appearance of the composite parts made from that mold. At the same time, having a strong and durable mold is important for manufacturing consistency, low mold maintenance and minimized operating cost. Consequently, the use of quality mold building systems is highly recommended, so part production can run without problems, yielding great and good-looking composite parts.



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Key factors for selection of a suitable mold building system are the high surface gloss level that can be obtained, the dimensional accuracy, high resistance against resin solvents like styrene, and mold durability (including resistance to the mechanical loads and the exotherm reaction during curing of the part). These

performances assure very long service time of the molds with very high final part quality all time.

### Mold quality

The final surface quality of the part mirrors the quality of the mold. So particular attention must be paid to ensure that the surface finish of the master pattern is in line with the desired surface appearance of the finished composite parts. A mold release agent applied onto the mold surface, should have good resistance against styrene and heat distortion temperature of at least 80 °C to assure the pattern surface and in the production of final parts. Euroresins presents an extended portfolio of mold cleaners, sealers, release agents and semi-permanents to help you on that important phase. When the master pattern is prepared and shows the desired surface after applying the last layer of demolding agent, polishing the mold construction can start with the new Rapid Tooling System. An optimal dust-free environment with defined temperature conditions between 20–25 °C is crucial for achieving perfect molds, with outstanding surface appearance and dimensional accuracy. Euroresins International group offers a high technology mold making system as a result of its partnership with BÜFA®, Aliancys® and United Initiators®M. The new tooling system consists of:

- BÜFA® Vinylester Tooling gelcoats
- Barrier coat and Skin coat
- Aliancys® new generation of Neomould® tooling resin with zero-shrinkage
- United Initiator's MEK peroxide Curox® products

Ideal product combination to achieve extremely durable, high gloss and high-quality molds for final part production in just one day, instead of week or more, provides important saving of time, personnel and money.

### BÜFA® Vinylester Tooling gelcoats

BÜFA® Vinylester Tooling gelcoats can be cured with Curox M-312 peroxide without gassing. Fast thixotropy recovery similar to standard gelcoats assures evenly applied gel coat layers without sagging or rinse in vertical surfaces. Euroresins International group offers two versions in brush and spray quality. Different colors according to customer needs are available, black, green, orange, gray and natural. The BÜFA® Vinylester Tooling gelcoat features high gloss and excellent resistance against styrene and additives present in sealers, cleaning and release agents. High HDT will prevent weir because of exotherm reaction from finished parts during service.

### BÜFA® Barrier coat

Filled resin formulation based on Vinyl ester resin, Epoxy Bisphenol A type, optimized for spray up application and pre-accelerated, ready to use. BÜFA® Barrier coat is applied as 2nd layer upon the cured gelcoat before starting laminate work, it hinders print through of shrinkage and fiber marks. Applied with a suitable gelcoat and laminate construction it provides GRP molds with optimal resistance against chemical attack and higher temperatures. In addition, it ensures excellent surface gloss and provides long service time of GRP molds.

### Atlac® 580 ACT

Vinyl ester urethane resin, is pre-accelerated and thixotropic. It combines exceptional chemical resistance with an outstanding combination of heat resistance and flexibility. The resin features very good handling and curing properties, excellent wet out of glass fibers and very good air release properties. This allows to easily and reliably build-up of the first layers onto the barrier coat.

In comparison to many other vinyl ester systems, Atlac® 580 ACT vinyl ester urethane resin produces less foam when peroxides are added, thus avoiding air bubbles below the barrier coat. This is important for assuring a shiny surface and for ensuring a long service time of molds (even when exposed to warm temperatures during service). In addition, the resin features a low exotherm during curing allowing to make two layers in one go without unfavorable influence on the mold gelcoat and the pattern surface.

### Atlac® E-Nova MA 6325

Atlac® E-Nova MA 6325 has been developed building on 40 years of unsaturated polyester and epoxy vinyl ester technology. The enhanced epoxy bisphenol-A vinyl ester modified polymer, is thixotropic and pre-accelerated. Also, the Atlac® E-Nova MA 6325 resin features excellent wet out and air release, avoiding formation of micro and macro air bubbles in the skin coat. The Atlac® E-Nova MA 6325 resins have a low styrene content of less than 35%, and therefore can be used as a high solid barrier coat resin. This is especially suitable for building bigger molds as the shrinkage of the large surface area of barrier coat layers is reduced.

## Neomould® 2017-S-1, the new laminating resin for mold production

The innovative Neomould® 2017-S-1 resin is a brand-new tooling resin introduced by Aliancys®. This resin will ultimately replace Neomould® 1982-S-1, so far considered to be the industry standard for making quality composite tooling. Neomould® 2017-S-1 resin is a filled system with increased thixotropic properties and a fine-tuned curing system (resulting in a better exotherm development). The resin is outperforming the Neomould® S 1982-S-1 resin and other molding systems commonly available in the market.

The higher thixotropy allows thicker laminate build-up in one go without the risk of resin slip or drain from vertical surfaces. The low viscosity level still allows processing by Hand lay-up and Spray-up application methods. A new accelerator system ensures that the exotherm reaction of higher laminate thicknesses is well controlled as shown in the table below. The peak exotherm in laminates up to 8 mm stays at a very low level and thus does not negatively affect the quality of the gel coat and appearance of the barrier coat. In addition, the low peak exotherm prevents formation of defects on the pattern surface like dull spots (Figure 1).

Tooling system	4 mm pattern side	4 mm mid laminate	8 mm pattern side	8 mm mid laminate	Unit
Neomould®2017-S-1	29	29	41	42	°C
Neomould®1982-S-1	32	33	42	45	°C
Competitor 1	34	34	46	48	°C
Competitor 2	38	38	64	68	°C

FIGURE 1

Peak exotherm development.

Tooling system	Dimension A	Dimension B	Average	Unit
Neomould® 2017-S-1	-0.01	+0,08	+0.035	%
Neomould®1982-S-1	-0,02	+0.03	+0.005	%
Competitor 1	+0.01	-0,08	-0.035	%
Competitor 2	-0.05	-0.011	-0.080	%

FIGURE 2

Dimensional changes in two directions 8 mm laminate, post cured at 40 °C.

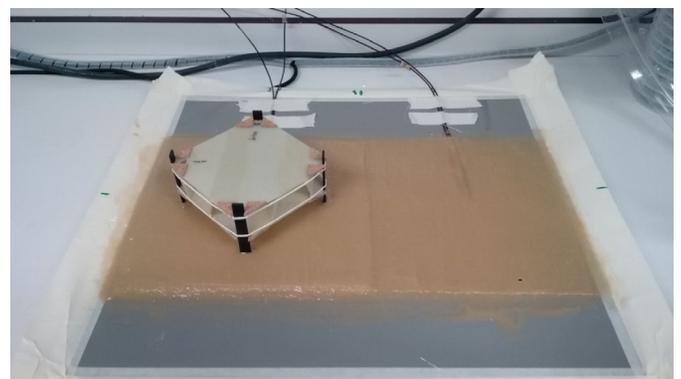


FIGURE 3

Testing method and device (Source: Aliancys®).

During cure the laminate deploys zero shrinkage, important to mirror perfectly the surface of the tool and for assuring high dimensional accuracy.

Positive dimensional changes in optimal laboratory conditions are important to assure that dimensional accuracy is guaranteed at varying work shop conditions. Neomould™ 2017-S-1 can be cured with Curox® M-312 peroxide and contains a peroxide indicator system. The resin was designed for easy processing allowing quick wet out of fibers without drag on roller. The color of the resin allows easy detection and elimination of air pockets during lamination. The resin exhibits tack-free cure without negative effect on secondary bonding (Figures 2 and 3).

### One curing agent for the entire system

The Curox® range offers peroxides with low water- and hydrogen peroxide content improving the osmosis resistance and in mold production assures lowest porosity as the formation of gassing with all the products of the mold making resin system is limited. The main features are very good through cure and moderate evolution of exotherm reaction.

The Curox MEKP products are suitable for curing all kind of UP and Vinylester resins at ambient temperature. The standard dosage level ranges are from 1–3%, in the elaboration of molds; we recommend applying between 1–2% Curox M-312 depending on the resin system and the layer thickness.

### Rapid Tooling System

BÜFA® VE Gelcoat: 700–800 microns, applied in two layers (minimum 500 microns in first layer). The gelcoat will be catalyzed with 1,5–2% of Curox M-312 Gelcoat can be applied by brush or spray. In case of spray up application it is recommended to check spray pattern, degassing and gel time by a spray test on a carton. It is useful to apply in the second gel coat layer a different gel coat color as this allows easy visual control during application.

1 layer of 700–800 microns Büfa® Barriercoat VE (optional). Applied as a kind of additional Gelcoat layer, BÜFA®-Barriercoat improves surface cosmetics and resistance against styrene. BÜFA®-Barriercoat is based on a Vinylester resin. Due to its excellent mechanical properties and low shrink curing behavior, it will help to avoid fiber print through on the mold surface. Due to the special composition and excellent chemical resistance it will improve substantially the resistance against chemical attack by styrene and wax additives.

Skincoat, 2 layers of powder bound CSM 225 g/m<sup>2</sup>, preferred 300 g/m<sup>2</sup> with Atlac 580 ACT or Atlac E-Nova MA 6325. Take care to avoid overlay areas of the mat layers in order to avoid print through on the surface. Take care to avoid resin reach areas i.e. in corner areas or at the base of inclined areas. Apply sufficient resin before laying down the mat layers in order to exclude trap of air bubbles directly below the gelcoat and barrier coat layers as such bubbles might lead to porosity of the mold surface when used in production.

Neomould® 2017-S-1 calls for the application of minimum 4 layers of emulsion CSM 450 g/m<sup>2</sup> in single application step wet on wet respectively the same amount of chopped glass fiber and resin in one go by spray-up. Preferred catalyst levels are 1,5–2% of Curox M-312. The favorable curing and the thixotropic proper-

ties of Neomould® 2017-S-1 allow application of up to 8 layers in one go. For best results in terms of surface quality and dimensional accuracy it is recommended to add the curing agent in hand layup process for the whole resin quantity needed in one go. If the gel time of such mixture is too short and various mixtures have to, care must be taken that such mixtures are applied wet in wet and minimum in 4-layer thickness. Due to the specific weight of the filler separation cannot be avoided. Therefore, it is mandatory to homogenize the entire packaging before taking out even smaller quantities. Allow the mold for proper curing and if post curing is foreseen please keep the mold on the pattern. Finally wait for the mold to cool down properly and take off carefully.

Your mold will show excellent dimensional stability, high gloss, hardness and abrasion resistance and when properly started up and treated during service will ensure high number of replicated parts. Our technical experts jointly with our principals will support you with advice and quality products for the construction of your mold irrespective of application (hand-lay-up or spray-up) and will also assist with the best products for high quality end products and protect your mold during service. Useful general hints for elaboration of the perfect mold:

#### Do

- Stir all gelcoat and resin products before use and even when taking out smaller amounts from the pails.
- Use 2% MEK-peroxyde Curox M-312 for the Vinyl Ester gelcoat to prevent under-cure.
- Apply the gelcoat in 200–300 micron passes when applying by spray, waiting two minutes for the de-aeration before applying a second layer (Figure 4).
- Ensure that the layer thickness of the gelcoat is uniform.

#### Don't

- Never use gelcoats and tools at temperatures below 15 °C.
- Don't apply the gelcoat thicker than 1000 microns in total, as this may lead to cracks on the surface in the mold respectively during service.



FIGURE 4

Neomould (Source: Aliancys®).

**About the author**

Euroresins International group with more than 40 years in the distribution composite market is at the forefront of innovation always very close to our customers, offering you the latest

innovative products to convert your ideas into a reality. Contact us and an expert technical and commercial team will advise you about the best system for you.

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