

# Eco Mould Tooling System Guide

## 1. Introduction

DIY Eco Mould is our economically priced, Vinyl Ester and Polyester mould making system that can deliver fantastic results whether on large or small moulds. It offers a versatile and robust mould that can be used for wet lay and infusion purposes with stunning results. It has also been used for short run low temperature pre-preg curing with out of autoclave systems such as our DIY HQPP prepreg range although it is not recommended for this where instead we would suggest using our High Temp Epoxy Mould System .



## 2. Materials list

Before starting a project using our Eco Mould system we make sure we have the following to hand to assist in completing a successful project. If you don't have them all of these items are available at [diycomposites.co.uk](http://diycomposites.co.uk)

- DIY Eco Mould System (one of our kits or kit items purchased individually)
- DIY Let Go Release Agent
- DIY Release Wax (Optional)
- DIY Fillet Wax
- Laminating brushes / buckets / Bristle Roller
- Weighing scales
- Mixing sticks
- Acetone
- DIY Mould Cleaner
- PAI Just One Polish & Micro fibre cloths

## 3. Compatibility Chart

Compatible Component Resins		Compatible Laminates		Production Methods	
Polyester	✓	Chop Strand Matting (CSM)	✓	Wet Lay (ambient)	✓
Vinyl Ester	✓	Woven Glass	✓	Infusion (ambient)	✓
Epoxy	✓	Carbon Fibre	✓	Pre-preg (low temp)	✓
		Flax	✓		
		Kevlar	✓		
		Carbon Kevlar	✓		

The system is made up of 3 basic products that are applied in the following order;

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- DIY VE Tooling Gel Coat – A high quality tough and durable vinyl ester gel coat that polishes well to give excellent mould surface finish.
- DIY VE120 Laminating Resin – A premium vinyl ester laminating resin chosen for its low shrinkage and high strength. Used for its excellent qualities in bonding together the gel coat surface with the main tool re-enforcement
- DIY PE80 Tooling resin – A polyester resin used to add fast bulk and re-enforcement with chop strand matting (CSM) to support the tool. Chosen for its good dimensional stability.

#### **4. Pattern Preparation**

Your pattern can take a number of forms. It could be an original component that you wish to mould from or a bespoke pattern you have made for your project. Whichever approach you take ensuring you prepare your pattern correctly at this stage is one of the most critical points of the whole tooling process. Errors at this stage could mean the mould will not release correctly from your pattern or maybe damaged when de-moulding.

After reviewing the component that you plan to use as a pattern you must first decide if it is suitable for a single piece mould or whether due to negative draft angles that would stop the pattern releasing you will need split lines in your mould. You can see in our example a single piece mould will be fine. For more advanced mould making approaches including making multiple part split moulds and infusion mould flanges please see our advanced moulding tutorial.

It's also important to consider your manufacturing technique. If you are going to be infusing your component, then the mould will require larger flanges to accommodate the infusion hardware. If you are simply using wet lay then the flanges can be smaller.

To assist in creating your flanges for this single piece mould you may wish to mount the pattern to a smooth surface capable of having release agent applied to it for example some glass or alternatively you can fabricate your own flanges using corex signboard, hot melt glue and flash tape which are all available at [diycomposites.co.uk](http://diycomposites.co.uk)

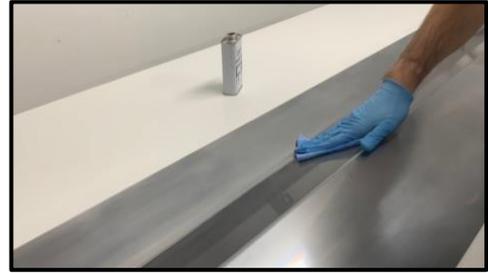
Always remember that the surface you see on your pattern will be directly repeated in the mould surface, so any imperfections will be clear to see in your mould, so take as much time as is possible at this stage to make sure your patterns surface is as smooth and shiny as possible as this will improve the surface of your mould, reduce any potential re-finishing following demoulding and lead to better surface finish on components you make from your mould.

Once your component is mounted to a surface it's important to ensure any edges or shapes that could allow the gel coat layer to reach a negative angle are filled with fillet wax to help with getting a clean release from your pattern. This wax is easily applied by hand and is simple to manipulate and shape and clean up by hand or using a simple fillet ball tool as pictured to help achieve a constant radius.

#### **5. Release Agent**

The final step and most critical step of our pattern preparation prior to adding gel coat is to make sure that the pattern and any areas gel coat will be added to including proposed mould flanges are

treated with release agent. Both release wax and PVA release agent are established release materials however where budget allows DIY Composites always recommends the use of our DIY Let Go release agent in place of either PVA or Wax products. As a semi-permanent chemical release agent we have found more consistent and effortless releases when using this product. DIY Let Go release agent is applied in a number of coats. Please follow the data sheet for the exact process.



## 6. Gel Coating

The gel coating stage described here in part 6 and the re-enforcement part 1 described in stage 7 below should be completed in one session before being left to cure over night, so make sure to allow enough time for this process which in our experience dependent on the size of the mould is typically around 5 - 6 hours including laminating and curing times.

For this stage use our DIY VE Tooling Gelcoat which is a high-quality Vinyl Ester tooling gel coat. The gel coat layer will be the visible surface of your mould once the moulding process is complete and the mould removed from the pattern. The gelcoat is easily mixed by hand in a mixing cup and catalysed with DIY MEKP Catalyst mixed at 1.5% - 2% (So to 1kg of gel coat add 15cc – 20cc of MEKP) and is applied to the pattern by brush in 2 coats.



**Coat 1 to tack stage** – The first coat should be applied to roughly a 0.5mm thickness. It should be applied in smooth and even brush strokes avoiding any pools of gel coat. You may not get 100% coverage on the first coat. It is not unusual to see small pinholes of 1-2mm in diameter open up in the first coat. This will be more prevalent with the use of DIY Let Go release Agent. It is due to the efficiency of the release agent but these holes will happily fill once the second coat is applied. Once applied the first coat should be left to reach the tack stage. At DIY Composites we class the tack stage as when a finger can be lightly drawn across the gel coat and when lifted away no gel coat residue is left on your finger, however if you were to push the gel gelcoat more firmly with your finger you would leave an imprint. Dependent on ambient conditions and the accuracy of your mix this should take between 1 hour – 2 hours.



*Make sure not to let the gel pass the tack stage*

**Coat 2 to Tack stage** – Once coat one has reached the tack stage then it is ready to have the second coat applied. This again should be mixed and applied in exactly the same way as coat 1 and left to reach the tack stage in the same way. There should be no voids at all in gel coverage. Once you are at the tack stage with this second coat the project is ready to move immediately to the first stage of re-enforcement.

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## 7. Re-Reinforcement Part 1 (Vinyl Ester)

The first re-reinforcement in this mould making process is completed with a layer of surface tissue followed by a single ply of 300g Chopped Strand Matting (Emulsion Bound) and our DIY VE120 Laminating Resin. This combination provides a strong and dimensionally stable layer to not only create robust bond with the gel coat but also provide a great surface for the remaining layers of polyester re-reinforcement that follow in step 8 below to bond to.

**Surface tissue re-reinforcement** - Once you have prepared your surface tissue so you can ensure a single layer of coverage over every surface of the mould which may involve templating or tearing / cutting material to shape then mix your VE120 Laminating resin and catalyse at 1.5% - 2% again (to 1kg of resin add 15cc – 20cc of MEKP or pro rate to whatever amount of resin you mix). Thoroughly mix and apply a layer of the resin directly onto the gel coat that should still be at its tack stage.



Once the entire surface of the gel coat has a layer of VE120 laminating resin on it then add your surface tissue and with your remaining resin and laminating brush ensure thorough wet out of the surface tissue on every part of the mould surface. It is extremely important at this stage that the tissue conforms completely to the gel coat surface with no voids or air entrapment as this tissue works as a support structure behind the gel. Once this process is complete then you are happy the tissue conforms perfectly to the gel coat then you are ready to move on.

**300g CSM (Emulsion Bound) re-reinforcement** - Following on immediately from the surface tissue re-reinforcement a single ply of 300g CSM should be laminated onto the mould. As the surface tissue will still be wet the CSM can be added on top of it and should be thoroughly wetted out from above with a laminating brush with DIY VE120 laminating resin. As always it is extremely important to avoid any air entrapment and ensure there are no air voids and bridging to the laminate below. Following this stage once the laminate is fully consolidated and wetted out it can be left overnight to cure ready for



## 8. Re-reinforcement part 2 (Polyester)

After leaving your mould over night to cure the final laminating stage can commence. In this step the bulk re-reinforcement is added to the mould which uses our Polyester PE80 Tooling resin and 450g CSM Emulsion Bound. Prior to commencing the laminating we recommend a brief sand over the surface of the laminate with a P120 sand paper to provide a light key and remove any fibres that stick up that may hold off any of the next



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laminates that are to go down causing air voids.

**Option 1 - Single session re-enforcement** - It is now possible, dependent on the mould size to add the entire remaining bulking laminates to the mould in one session. This can be completed with 4 x 450g CSM plys applied wet on wet. This should give a tool thickness of around 7mm in total.

**Option 2 – Double session re-enforcement** - For ultimate tool strength and to reduce any flexibility in the tool we recommend laminating 3 plys of 450g CSM in one session, then allowing the resin to cure over a period of 3-4 hours before laminating another 3 plys of 450g CSM. If using this approach after the first 3 plys and their cure, a P120 sandpaper should be used again lightly prior to the second laminating session commences.

This laminating process works exactly the same as the part 1 re-enforcement process. Once your resin is mixed and again catalysed just as before. The PO80 laminating resin should be painted onto the cured mould surface that has been freshly keyed with P120 sandpaper. Once an even layer is painted by hand onto the whole area then the 450g CSM can be added. It may require tearing or cutting into shape and once added to the mould it should be thoroughly wetted out by hand with a laminating brush avoiding any dry spots and any air entrapment. Following each ply use of bristle roller is recommended to help eliminate air bubbles, smooth errant fibres and consolidate the material in general. Once laminating is completed the mould should be left to cure for 24 hours.



*Add a coat of PO80 prior to the keyed surface prior to adding the first 450g CSM*



## 9. De-moulding

The mould must be left for at least 24 hours at room temperature (20 – 25 degrees) prior to demoulding. Demoulding is a simple process when using our demoulding wedges. Simply find a suitable corner and begin to gently work the wedge between the mould surface and the pattern or mould flange. If correctly released the mould will soon come away from the pattern. If you are choosing to post cure and have a pattern that is capable of withstanding the post cure temperatures, then de-mould following your post cure.



## 10. Post Curing

It is absolutely acceptable to use the mould following its ambient curing process. However, if possible, to achieve maximum physical properties an 8 hour post cure of the mould is suggested at 50 degrees. This is best on the pattern if the pattern material is suitable or can be completed off the pattern if it is not. By doing this it allows any solvents remaining in the laminate to evaporate off and

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helps to promote cross linking of polymer chain that help add to the moulds strength as it is exposed to temperatures higher than the ambient conditions which the resin cures at.

### 11. Mould Trim

At this stage the mould can be trimmed and have its edges cleaned up to remove any sharp areas. In this example we are using a rotary cutting tool fitted with a perma grit cutting wheel which makes quick and easy work of the job.



### 12. Clean & Polishing

Following the de-mould and post cure process the mould will undoubtedly be left with release agent and fillet wax residue on it. This is easily removed with use of DIY Mould Cleaner which is applied with any lint free rag by hand and will quickly clean up these build ups.

Following a clean up of the mould surface so the surface is completely clear then a polish is recommended to make the gel coat shine. Effort at this stage to achieve a gloss will be reflected in the final components that are made in the mould.



We recommend using our preferred PAI Just 1 polish for gel coat surfaces such as this. The polish acts not only as cutting compound but also a polishing compound to help give an excellent final shine. This can easily be completed with a polishing wheel or by hand with a simple 2 cloth (microfibre) approach. One cloth to put on and polish in circular motions and another cloth to buff off.



### 13. Sealing and Releasing

After the moulds final polish then it should be sealed with DIY Tool Sealer 12. Tool sealer provides the mould surface with an impermeable barrier that aids gloss, supports a better release surface and will assist with tool durability. This is built up in layers and full instructions on its application are included on the product data sheet as are full details of the application of DIY Let Go release agent which will offer a semi-permanent release agent that once first applied to a new sealed mould surface only needs minimal applications for subsequent re-uses of the mould.

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Please always ensure you prepare yourself with suitable PPE for the process you are completing

