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Basic Layup Using Polyester Resin

Basic lay-ups are fairly difficult to define because they can be changed to do a number of different things. However, in this "How to" sheet we will assume a few points.

- 1) That a gelcoat is being used and 2) that fibreglass will be used as the reinforcement.

Two terms you should become familiar with are glass reinforced plastic (GRP) and fibre reinforced plastic (FRP) *i.e.* the reinforcement is the glass and the plastic is the resin. Therefore the common terms like "fibreglass boat" are not quite true as fibreglass by itself isn't much good at keeping the water out! FRP is more commonly used when Aramid fibre (Kevlar) or carbon fibre are used.

Polyester resins are the cheapest of the commonly available resins and come in basic types – Isothalic or Orthothalic. Isothalics have greater resistance to chemical attack so they are used in situations like the manufacture of tanks. Isothalic resins are also more expensive. A finished GRP panel whether it be a flat sheet or a moulded component is a matrix of polyester resin and a number of layers of glass reinforcement. This panel will have been moulded using a mould of some description. It may be a GRP mould, a metal, plaster or plastic mould – for instance around the home you will commonly find pressed metal trays, the sort you might serve coffee on. Using this tray as a mould (Figure 1), we could lay a GRP laminate on to it.

First make sure the mould (tea tray) is clean and free of oil or dirt. Then apply 2 coats of a release wax as per the directions on the can. Allow 5 to 10 minutes for the wax to harden. Pour some release agent (PVA = poly vinyl alcohol) into a shallow dish. Take a piece of sponge – the type you use for washing up (but use a new piece!) and saturate it in the PVA release agent. Swab the whole tray, making sure that you don't miss any areas – particularly around the edges. Squeeze the excess back into the dish and work again over the entire surface, removing all excess. PVA doesn't have to be thick as long as it is there it's enough!! Allow to dry. In the winter this takes a while but you can hasten the process by wafting a hair dryer over it. The excess PVA can be poured back into the bottle. When the PVA is dry, you are ready to tackle the gelcoat.

How much gelcoat do you need? Rule of thumb is approximately 500gm per square metre. Assuming our tray is 1mtr long and 0.5mtr wide, we would require 250gms of gelcoat. This should be *weighed* using scales. Kitchen scales will be suitable for this (protected by an inverted plastic bag of course!). The cheapest gelcoat is usually white. If you wish to use a coloured gelcoat you can purchase it ready coloured or more commonly, purchase neutral gelcoat and add pigment. Never add more than 10% pigment (by weight). Usually with the darker colours like black, blue, green, red etc 5% is enough. Remember this if you are trying to tint a white gelcoat to grey, the white will already have approximately 7% pigment added so 2 to 3% extra will be the maximum you could add.

Back to our tray – we have 250gms of white gelcoat in an ice-cream container (or similar) and we add the catalyst (MEKP – methyl ethyl ketone peroxide) at a ratio of 2% (1% = 10ml per 1kg resin). MEKP is very dangerous, so **please ask for our information sheet on MEKP.** 2% = 20mls per 1kg, so if we have 250gms of resin then we need 5mls of MEKP. MEKP should be measured with a medicine glass or similar. Pour the catalyst into the resin and stir thoroughly with a stick to ensure there is no un-catalysed resin around the edges.

Using a clean brush, paint the mould with a thick coat of gelcoat – QUICKLY! The gelcoat should be about .5mm (.2") thick. If you can see through it, it is too thin. If it runs off, it is too thick. Use the brush at a 45 angle and use the tips of the bristles to lightly smooth the gel out to an even finish. Wash the brush in acetone. Depending on temperature, it will take the gelcoat 2 to 5 hours to harden sufficiently enough to continue on. When the gelcoat is hard but you can still leave a fingerprint on the surface without getting your fingers sticky, you are ready to go on.

For this example we will assume that you are using 2 layers of 225gm chopped strand mat (CSM) as reinforcement. This is rated by its weight per square metre. The common mats used are between 225 and 600gm per square metre. This used to be rated in ounces per square ft and 2oz per square ft equals 600gms per square metre. Cut 2 layers of CSM to cover the tray/mould and overlap the edges of the by 10 to 15mm.

How much resin will we require? Again, the rule of thumb; weigh the total amount of mat to be used, and multiply it by 2.5. For this example, we would have approximately 225gms of glass, which would need approximately 560 grams of resin. For convenience increase this to 600gms. Catalyse this at 1%, (which equals 6mls of catalyst) and mix thoroughly into the resin.

Quickly brush a sloppy coat of resin on to the gelcoat and then lay the first layer of glass onto the wet resin. Wet this layer with more resin using a stippling or dabbing action. The CSM fibres are held together with a binder, which takes about half a minute to dissolve once the resin is applied, so continue to wet out the whole area returning to the first part when all is wet. By then the binder will have dissolved and you will be able to stipple the wet glass down on to the gelcoat. As soon as the first layer of the laminate is down, put on the second in the same manner. When this is complete, take a roller of an appropriate size and gently roll out any entrapped air. Wash both the roller and brush in acetone and leave the job to cure for at least 24 hours.

To remove the mould, first work away the edges. Usually a thin wooden wedge can be slipped under the edge and worked around. This will "pop" our GRP tray away from the metal tray mould. Trim the edges off using 24" hacksaw blades, sawing at a 45 degree angle. The edge can then be filed and sanded using paper about of about 80 or 100 grit.

The GRP tray will still have a coat of PVA release agent adhering to it, so wash it under water to clear this away. "Hey presto!" you have completed a moulding! If you wish you can wax and release the smooth surface of your moulding and repeat the procedure, which will give you an exact replica of the original tray.

Don't try and take any shortcuts, particularly in the weighing and measuring dept. – it just isn't worth it. If you follow the procedure described here you won't have any problems and you will be able to manufacture all manner of things!

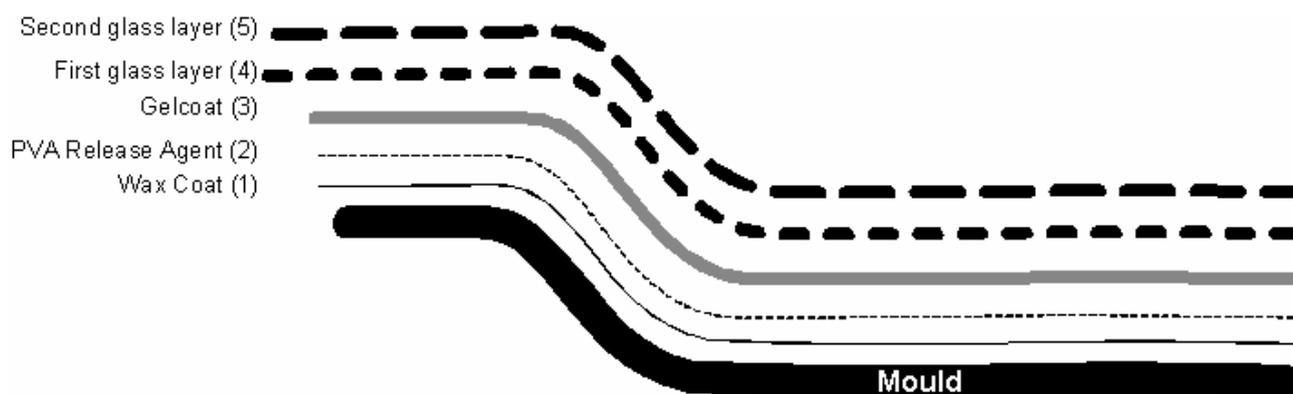


Figure 1: *Just about anything can be used for a mould!* Here we show a metal tea tray and the steps taken to make a FRP copy. (1) and (2) Release wax and release agent are used to ensure that the FRP can be removed from the mould. (3) Gelcoat is applied to give a smooth, coloured outer layer and protect the underlying fibre. (4) and (5) Glass, Aramid or carbon fibre is then used to make the laminate.