DATA SHEET

Polyfibre Limited

18 Wainwright Street, Aston, Birmingham B6 5TJ

Telephone: 021 327 2360 Fax: 021 327 3089

TOOLS AND MATERIALS

MATERIALS

The materials required for glassfibre laminating will obviously vary according to the project being undertaken, but most jobs would typically need the following:–

GC100 (GELCOAT) A thixotropic resin which covers evenly without running. This forms the smooth, shiny, exterior surface of the finished item – it is therefore applied first to the mould. A kilo of gelcoat will cover a little over a square metre of mould surface.

PF100 (LAY-UP) A thinner, non-thixotropic, general purpose resin used when laying-up the glassfibre material. Approximately one kilo of resin is needed per square metre of 450 gm^2 glassfibre.

CATALYST Both gelcoat and lay-up resin must be catalysed to start the curing process. The catalyst, or hardener, is added in a ratio of 2% by weight *(i.e. 20cc of catalyst per kilo of resin).* Lay-up resin, can be used with 1% catalyst (10cc per kilo of resin), especially in hot weather when the resin might otherwise cure too rapidly. As the curing process begins as soon as the catalyst is added, never make up a larger quantity of resin than is immediately required. And remember that the resin will cure faster at high temperatures, so you will have to work more quickly on a hot day! Catalyst is an organic peroxide (a powerful corrosive) and should not come in contact with the eyes, mouth or skin. Should it do so, wash from the skin immediately under a running tap. If it is splashed in the eyes, flush them with running water for at least fifteen minutes, and call a doctor.

PIGMENT Resin is normally coloured by the addition of a pigment paste, in a ratio of not more than one part pigment to ten parts resin, by weight *(100gm pigment per kilo of resin).* With black and some other dense pigments, a lower ratio will be adequate. Add the pigment before mixing in the catalyst.

RELEASE AGENTS Compounds which repel polyester resins, thereby preventing laminated articles from bonding to the mould. Conventional car waxes and other polishes should not be used, as they often contain additives to which the resin will adhere.

GLASSFIBRE Various glassfibre materials are available, the most popular being chopped strand mat.

BARRIER CREAMS It is advisable to use special barrier and cleansing creams to protect the skin.

ACETONE BRUSH CLEANER For removing uncured resin from brushes and rollers – ***DO NOT*** *use on the skin!*

THESE MATERIALS ARE NOT SUITABLE FOR CHILDREN, UNLESS UNDER SUPERVISION.

EQUIPMENT

Like materials, the requirements for tools and accessories will vary according to the project, but the following are likely to be needed:–

MIXING CONTAINERS Cups and buckets made from a suitable plastic *(one which will not be attacked by the resin).*

BRUSHES AND/OR ROLLERS For applying resin. Use brushes or rollers specifically designed for GRP work – conventional decorator's tools often use adhesives which are attacked by the resin.

METAL ROLLERS For consolidating the resin/glassfibre layers.

CATALYST DISPENSER Catalyst should not be allowed to come into contact with the eyes or skin – always use a specially designed safety dispenser.

PLASTIC GLOVES These protect the hands from glassfibre materials and resins, and should be used in conjunction with suitable barrier creams.

WORKING AREA

Always work in a well-ventilated area at a temperature of about 20°C. Do not smoke or use naked lights or fires in the work area.

MAKING A MOULD

A mould in which to lay up the glassfibre laminations is the first essential in nearly all GRP projects. Some jobs require only a simple mould – you can produce flat glassfibre panels on no more than a Melinex covered sheet of hardboard. Moulds fall into two basic groups – male and female. The glassfibre is laid up on the outside of the male mould and on the inside of the female. As the finished item will have a smooth, shiny surface on the side nearest the mould, a female mould is used for items requiring a smooth exterior (car body panels, boat hulls, etc.) and a male for those needing a smooth interior (paddling pools, shower trays etc.)

You can use most solid materials for mould construction – wood, plaster, hardboard, clay, concrete etc. – the choice depending on the shape required and your own skill, but the best material is undoubtedly glassfibre itself.

THE "PLUG"

The first step in producing a glassfibre mould is to make a pattern or former, commonly known as a "plug" – an exact mock-up of the finished item. The plug can, of course, be an existing example of the real thing – e.g. a mould for a replacement car body panel can be made from another car of the same make.

Similarly, a mould for a canoe or dinghy can be taken from an existing boat – although you should be wary of infringing design copyright. In most cases, you will have to build the plug yourself. Almost any materials can be used, so long as the plug is accurate, rigid and has a highly finished surface.

Typically a large plug would incorporate a rigid wood frame work covered in plywood, hardboard, clay or plaster *(reinforced with wire netting or hessian)* – or any combination of these.

Whatever material you use, the surface must be completely smooth and free from blemishes, since the glassfibre mould will faithfully reproduce any flaws. Nails should be hammered well in, using a punch, screws should be countersunk, and the heads covered with filler. Dents, holes, seams and joints should all be carefully filled. Body Filler is the best, although plaster, clay or even plasticine can be used. Wooden plugs should be thoroughly sanded down, the grain filled, and covered with several coats of G4 Sealer or Polyurethane varnish. Plugs made from plaster or other porous materials should be well sealed with G4 Sealer or Polyurethane Varnish, waxed and polished.

Although it demands a great deal of hard work, getting the best possible finish on the plug will pay dividends later!

THE GRP MOULD

The plug must now be treated with release agents – three coats of Release Wax, followed by one coat of P.V.A. – and then the mould itself can be produced by laminating over, or into the plug.

The same method is used as for any other glassfibre lay-up – a layer of Gelcoat, followed by successive layers of glass mat and general purpose resin (see overleaf). The only difference is that the laminations need to be much thicker on a mould than on the finished item. It is easier to remove air pockets if the first layer of mat behind the gelcoat is a lightweight one, such as 300gm^2. This should be thoroughly consolidated with a metal roller, and, if possible, allowed to set before applying the next layer.

As a general rule, the mould needs to be twice as thick as the finished item to be made in it. On large moulds, where this would involve considerable expense, economies can be made by the judicious use of stiffeners and strengthening ribs. These ribs should be added after the mould has partly cured, otherwise contraction of the laminate around the ribs may leave an impression on the mould surface. The ribs are easily made by laminating over a former of paper rope, polyurethane foam, cardboard or wood. The resulting channel section gives extra rigidity and strength – the former itself does not normally provide any reinforcement.

If the plug has a deep draught or undercuts, it will be difficult (if not impossible) to remove the mould unless it is made in two or more sections. This is typically the case in boat hulls, where the mould may be split along the keel line to allow for "tumble-home" at the stern. The sections should have flanges about 75mm wide and at least 50% thicker than the rest of the mould. The flanges can be drilled to enable the sections to be bolted together.

Leave the mould to cure thoroughly (at least two weeks is desirable) before removal of the plug. Too early removal can result in distortion. If needed, build a timber framework and bond on to the mould. Once released from the plug, it is a good idea to drop the mould back on to the plug and allow it to "breathe" for a couple of days after which the mould surface can be examined for any imperfections which may need filling, or smoothing down. Very little of this work should be required if the original plug was properly finished.

Treat the mould with release agents prior to lamination of the finished article. Use between two and six coats of Release Wax, buffing between each coat and leave at least two hours between each coat to let it harden. Then apply a coat of P.V.A. After this has dried, the mould is ready to use.

LAMINATING

Cover the prepared mould surface with catalysed gelcoat (GC100). Wait until the gelcoat has hardened to a tacky condition. *(when it feels slightly sticky, but does not actually adhere to the fingers).* Make sure there are no crevices or corners in which the gelcoat is still wet, then paint over it with catalysed general purpose lay-up resin (PF100). This is much thinner than gelcoat. On this, lay a piece of glassfibre mat and push it into the wet resin with the brush, using a stippling action. **DO NOT** "paint" backwards and forwards, as this will cause the glass fibres to separate. More resin can be added if necessary, to ensure that the glassfibre material is thoroughly impregnated. When the mat is completely "wetted-through" the layer should be rollered with a metal laminating roller to force out air bubbles and consolidate the resin/glass matrix.

Once consolidated, a further coat of catalysed PF100 and another layer of mat can be added, and the process repeated. Any number of layers can be built up, depending on the thickness and strength required. For many jobs, only two layers will be needed. It is not necessary to wait for each layer of mat/resin to set hard before applying the next, provided not more than two or three layers are built up at a time.

Whilst laminating, the resin on the brushes and other tools will begin to cure and, if left, will eventually set hard. To prevent this, the tools should be soaked in acetone, which will dissolve the resin. You should remember that acetone is highly inflammable – **DO NOT** smoke or use naked lights in the work area. All brushes and rollers should be dry before re-use.

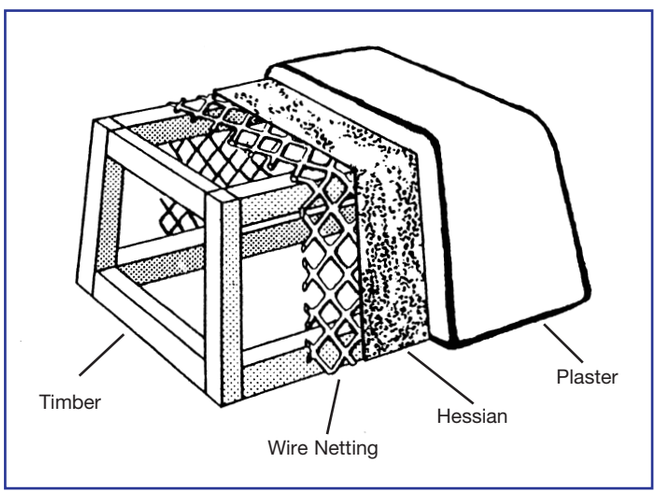
A thin laminate can be made much stronger or more rigid by adding stiffening ribs or box sections. These are easily produced by laminating over formers of paper rope, polyurethane foam or even cardboard.

Normally, a GRP laminate will have a smooth surface (that nearest the mould) and a rough surface. The rough surface can be given a more acceptable finish, by adding a layer of surface tissue or a layer of woven glassfibre, which must be applied whilst the laminate is still wet.

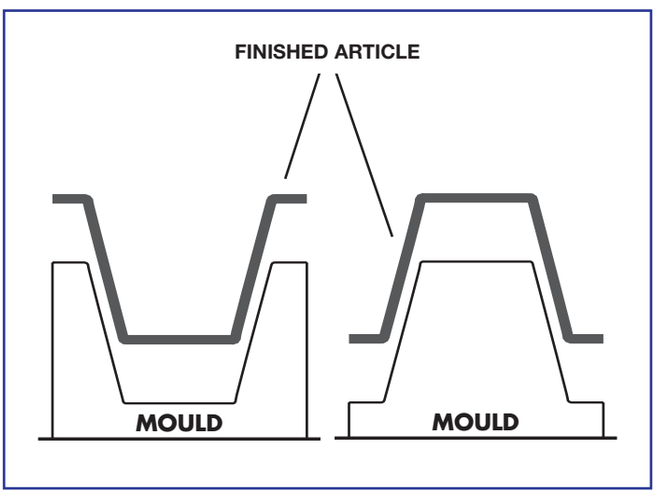
When all the necessary layers have been built up, the laminate should be left to cure. Rough edges can be trimmed off with a Stanley knife when the laminate has reached "green" stage – i.e. has started to go hard. Once fully hardened, trimming will require a hacksaw with a metal-cutting blade. (A breathing mask and goggles should be worn when machining GRP).

When cured, the moulding can be released from the mould. If this proves difficult, due to a complex mould shape or insufficient use of release agents, the moulding can sometimes be sprung out by striking the mould with the flat of the hand – **DO NOT** use a hammer, since this will probably crack both the mould and moulding! A rubber mallet can be used, but requires some skill. Wooden or plastic wedges (but not metal) can also be used to release a difficult moulding, although great care must be taken not to scratch the laminate or the mould.

This information is, to the best of our knowledge, true and accurate. Recommendations are made without warranty or guarantee. Users are advised to make their own tests to determine the suitability of specific materials or methods.



Typical construction of large plug – timber, wire netting, hessian and plaster.



Female (left) and Male (right) moulds.