



# Creating a Basic Fibreglass Laminate

Tools and techniques for fibreglass laminating

A step-by-step guide on how to create a fibreglass (GRP) laminate using hand layup methods

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# How to Create a Fibreglass Laminate

The aim of this presentation is to outline a basic step-by-step guide on how to create a fibreglass (GRP) laminate.

This guide is targeted at beginners as well as those looking to gain a practical understanding about basic fibreglassing techniques.



# What is Fibreglass?

## Fibreglass

Fibreglass is a composite material that blends both polyester resin and glass fibre. It is also known as GRP (short for glass reinforced polyester).

## Why combine polyester resin and glass fibre?

Both components have limited properties in an individual state. However, when combined to make [fibreglass](#), the limitations of polyester resin alone (brittle, structurally weak, etc.) and glass fibre (soft, permeable, etc.) are eliminated and the performance of the overall structure (fibreglass) is significantly enhanced.

### What is a composite?

[Composites](#) are "materials made up of a matrix and a reinforcement phase. Composites take advantage of directional properties of the reinforcement phase and gluing properties of the matrix. The reinforcement phase may be any material in fibre, platelet, or aggregate form. The matrix phase must be able to flow around the reinforcement and later hardened."

# Fibreglass (GRP): Properties & Performance

Fibreglass has many benefits as a form of surface repair and protection. These include, but are not limited to water resistance, resistance to a broad range of chemicals, a high strength-to-weight ratio, low cost versus other composites and fully customisable features with a multi-decade lifetime.

The physical properties of fibreglass are detailed below.

## *Fibreglass (GRP) Properties<sup>a</sup>*

| Parameter                          | Value          | Unit   |
|------------------------------------|----------------|--------|
| Tensile strength                   | 28.25 – 78.83  | MPa    |
| Flexural strength                  | 44.65 – 119.23 | MPa    |
| Impact energy (@ room temperature) | 3.5 – 6.5      | Joules |
| Hardness                           | 31.5 – 47.0    | BHN    |

*Note:* these properties can vary according to a wide range of parameters, from [glass fibre type](#) (length, thickness, composition), ratio of to glass fibre to polyester resin and the number of fibreglass [laminated layers](#). Other factors such as whether or not the material was produced by [hand layup](#) or by [spray layup](#) also has a role.

<sup>a</sup> <https://www.semanticscholar.org/paper/Mechanical-Properties-Of-Glass-Fiber-Reinforced-EL-Wazerya-EL-Elamyb/9c4108f15ad35ca81f6c604a5d47e1c944fd9161>

# Fibreglass (GRP) Laminating: Materials & Tools



## ***Materials & Tools***

In general, the following items are required for fibreglass laminate

- Polyester Resin • 450 or 600 g glass fibre chopped strand mat (CSM) • MEKP Catalyst/Hardener • Primer (optional) • Acetone\* • Paint brush • Polyester roller • Paddle roller • Latex gloves • Mixing sticks • Plastic mixing bucket

*Note:* a polyester roller or paint brush should be used to apply resin. Do not use a foam roller; this will dissolve in the resin and ruin the laminate.

# Fibreglass (GRP) Laminating: Catalyst Addition

Polyester resin requires a catalyst (typically MEKP) to be added in advance. This is added in a ratio of 1 – 4% of the resin required.

It should be prepared in workable amounts (1 – 2 kg), practiced in advance and used within 20 minutes to avoid curing.

The table opposite illustrates catalyst quantities. More catalyst will reduce the curing time.

## Fibreglass kits

- [Fibreglass pond lining kit](#)
- [Fibreglass flat roofing kit](#)
- [Fibreglass repair kit](#)
- [Fibreglass boat repair kit](#)

| Curing                                                                                | Slower curing<br>(Suited to warmer weather) |        | Faster curing<br>(Suited to colder weather) |        |
|---------------------------------------------------------------------------------------|---------------------------------------------|--------|---------------------------------------------|--------|
| Catalyst (%)                                                                          | 1%                                          | 2%     | 3%                                          | 4%     |
| Note: relative quantities of MEKP catalyst to be added in mL per weight of resin (kg) |                                             |        |                                             |        |
| Resin Amount                                                                          | Hardener Usage (mL)                         |        |                                             |        |
| 1 kg                                                                                  | 10 mL                                       | 20 mL  | 30 mL                                       | 40 mL  |
| 2 kg                                                                                  | 20 mL                                       | 40 mL  | 60 mL                                       | 80 mL  |
| 3 kg                                                                                  | 30 mL                                       | 60 mL  | 90 mL                                       | 120 mL |
| 4 kg                                                                                  | 40 mL                                       | 80 mL  | 120 mL                                      | 160 mL |
| 5 kg                                                                                  | 50 mL                                       | 100 mL | 150 mL                                      | 200 mL |
| 6 kg                                                                                  | 60 mL                                       | 120 mL | 180 mL                                      | 240 mL |
| 7 kg                                                                                  | 70 mL                                       | 140 mL | 210 mL                                      | 280 mL |
| 8 kg                                                                                  | 80 mL                                       | 160 mL | 240 mL                                      | 320 mL |
| 9 kg                                                                                  | 90 mL                                       | 180 mL | 270 mL                                      | 360 mL |
| 10 kg                                                                                 | 100 mL                                      | 200 mL | 300 mL                                      | 400 mL |
| 11 kg                                                                                 | 110 mL                                      | 220 mL | 330 mL                                      | 440 mL |
| 12 kg                                                                                 | 120 mL                                      | 240 mL | 360 mL                                      | 480 mL |
| 13 kg                                                                                 | 130 mL                                      | 260 mL | 390 mL                                      | 520 mL |
| 14 kg                                                                                 | 140 mL                                      | 280 mL | 420 mL                                      | 560 mL |
| 15 kg                                                                                 | 150 mL                                      | 300 mL | 450 mL                                      | 600 mL |
| 16 kg                                                                                 | 160 mL                                      | 320 mL | 480 mL                                      | 640 mL |
| 17 kg                                                                                 | 170 mL                                      | 340 mL | 510 mL                                      | 680 mL |
| 18 kg                                                                                 | 180 mL                                      | 360 mL | 540 mL                                      | 720 mL |
| 19 kg                                                                                 | 190 mL                                      | 380 mL | 570 mL                                      | 760 mL |
| 20 kg                                                                                 | 200 mL                                      | 400 mL | 600 mL                                      | 800 mL |

Note: mL = millilitres; kg = kilogram

# Laminating Protocol: Catalyst Addition



1. Add catalyst in a desired ratio (1 – 4 %) to polyester resin.



2. Carefully mix for 1 – 2 minutes, being sure not to introduce excessive air bubbles into the mixture.

# Laminating Protocol: Resin Application and Glass Fibre Placement



3. Apply a thin layer of catalysed resin to the intended surface using a polyester roller.



4. Place pre-cut glass fibre chopped strand matting (CSM) onto the resin-coated surface. Note that the surface area of resin coverage should exceed that of the glass fibre mat.

# Laminating Protocol: Laminating and Consolidating



5. Apply the catalysed resin to the glass fibre matting using a polyester roller. Ensure consistent coverage, as indicated by a colour change.  
Note: for 450 gram CSM, 1.2 – 1.4 kg of catalysed resin is used per square meter of matting. For 600 gram CSM, 1.5 – 1.7 kg is used. Be sure to test in advance.



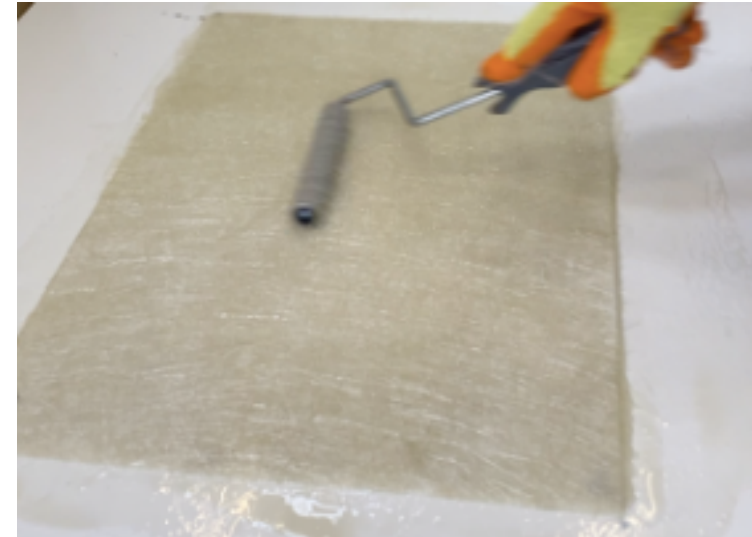
6. Consolidate the resin using a paddle roller.  
Note: moderate pressure should be applied to drive out excess air bubbles and create a more uniform laminate.

## Laminating Protocol: Second Layer (Optional)



7. If required, a second layer can be applied using the same procedure. Using the same process, this would create 2 layers of 450 gram CSM or 2 layers of 600 gram CSM.

Note: ensure that sufficient resin has been prepared in advance.



8. Using the same procedure, consolidate the laminate using a paddle roller. Once completed, allow to cure.

# Polyester Resin Safety Considerations

The chemical and physical properties of unsaturated polyester resin – the main ingredient and hazardous chemical in fibreglass have been extensively investigated over several decades. Some of these properties are highlighted below.

## *Hazard Labels*



## *Hazard statements*

H315 - Causes skin irritation  
H319 - Causes serious eye irritation  
H335 - May cause respiratory irritation  
H361d - Suspected of damaging the unborn child  
H372 - Causes damage to organs through prolonged or repeated exposure if inhaled  
H412 - Harmful to aquatic life with long lasting effects  
H226 - Flammable liquid and vapour

[Polyester resin health hazards](#) have been well documented for several decades pertaining to the resin itself and then individual ingredients such as [styrene](#) and catalysts such as [MEKP](#). These health risks aside, it is generally considered safe provided that adequate precautions (risk assessment, are taken and PPE is worn. Please perform a risk assessment and COSHH assessment in advance. Resin Library is not liable for any outcome.

# Links & References

Fibreglass has many other applications, some of which are listed below.

- <https://www.science.org.au/curious/technology-future/composite-materials>
- <https://femecheengineering.com/>
- [https://spinoff.nasa.gov/Spinoff2009/ip\\_2.html](https://spinoff.nasa.gov/Spinoff2009/ip_2.html)
- <https://dspace.mit.edu/handle/1721.1/86268>

The composites sector has many specialist institutes and training centres, such as:

- academia:  
<https://www.qub.ac.uk/schools/SchoolofMechanicalandAerospaceEngineering/Research/ResearchThemes/CompositeMaterialsandStructures/>
- Institutes: <https://www.brock.ac.uk/college-course/introduction-to-composites/>

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