

CARBON WORKS
Gorilla
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Carbon Fiber Repair Kit

This Gorilla Carbonworks CF Repair Kit has been put together by carbon fiber professionals with years of experience in carbon fiber composites. The materials used are the best available and as such this kit is designed for amateur and professional, including use by those new to composites altogether. The following pages should give you the essential, practical advice you need to produce your own carbon fiber parts or improve your skills with proven workshop techniques.

Kit Contents

- Real carbon fiber fabric
- Laminating epoxy resin
- Epoxy hardener
- 120 grid sand paper
- Release film
- 1" laminating brush
- Latex gloves, Mixing pot and Sticks



Uses for This Kit

- Repair damaged surface of carbon fiber parts
- Reinforce an existing product
- Repair a carbon fiber product such as a fishing rod, yacht mast/ boom, vehicle bonnet etc.
- Satisfy an urgent or small requirement for carbon fiber and resin in a professional composites workshop.

Principles of Wet-Lay Carbon Fiber Lamination

Using this carbon fiber laminating kit you will be producing carbon fiber parts using a process described as 'wet-lay' lamination. This is because you will be using liquid epoxy resin to 'wet-out' the dry carbon fiber fabric, allowing the resin to flow in and around the carbon fibers. The carbon fibers are described as the 'reinforcement' and the resin is the 'matrix'. Once the resin cures, it is the combined properties of the carbon fibers and the epoxy matrix (together, a composite) that make the material so strong.

When you laminate a product you will be putting carbon fiber down onto the inside of a mold. When the product is removed from the mold it is the material that was in contact with the mold that becomes your 'finished' side meaning that the important part (to create the best looking product) is how the first layer of carbon fiber is laid down into the mold. Subsequent layers of carbon fiber or other reinforcement will not be visible on the surface of the part.

Step By Step Practical Guide

Before starting to make your first part we suggest you:

- Ensure you have enough space to work, that the work area is free from dust and protected with newspaper or similar if necessary.
- Have to hand a set of scales, a hair-dryer, a set of sharp scissors and some lint-free cloth.

Stage 1 – Key up the damaged area/parts

Using provided 120 grid sand paper to prepare and smoothen the damaged surface for repair.

Stage 2 – Mix Epoxy Resin and Hardener for the Surface Coat

Put on a pair of the Latex gloves. Use the scaled mixing pot to measure 2 parts of the epoxy resin with 1 part of the epoxy hardener into the same pot. For example, 10ml of hardener should be mixed with 20ml of resin.

Using one of the mixing sticks stir the resin and hardener together thoroughly. You should spend a good few minutes mixing the two parts, particularly as at colder room temperatures they may be very thick. Ensure you mix all the resin and hardener from the edges of the pot as unmixed parts will not cure and will ruin your finished part.

Specification:

Work life : 30 minutes at 70°F

Cure time : 24 hrs at 70°F reduce cure time – heat to 100°F

Stage 3 – Apply the Surface Coat of Epoxy Resin

EXPLANATION: In this next step we mix some epoxy resin with epoxy hardener to make a surface coat for our part. The surface coat will provide a thin-layer of clear resin on the surface of our part without any carbon fiber reinforcement in it. The reason we do this is to create a part with a smooth, glossy finish free from any fibers touching the surface meaning that any polishing or repair work we do to the surface of the part will not break through to the fibers and detract from the glossiness of the part.

The second reason for this step is to create a tacky surface which we can press the carbon fabric onto, holding it in-place whilst we wet it out with resin, hopefully preventing it from lifting away(or bridging) from the surface of the mold and creating what we is known as voiding.



Next, still wearing the Latex gloves and using the 1" laminating brush, apply a thin and even coat of the mixed resin to the surface of the mold. Ensure that you get the resin into any awkward corners of the mold but be very careful that you don't end up with thick pools of resin in these areas otherwise the finished part will have visibly 'milky' corners where there is a thick layer of resin obscuring the carbon fiber beneath.

Once you have applied this coat, set the mold on one side and leave for between 1 1/2 and 4 hours depending on the temperature of the room you're working in. The resin will cure quicker in a warmer room and slower in a colder room. Keep checking until the resin in the mold is slightly firm and tacky. If your glove sticks slightly to the resin without any of it coming off on the glove then the level of tack is about right.



In a workshop, resin is cleaned from brushes and other laminating equipment before it cures using acetone. As a hobby laminator, your best access to something similar would be a large container of nail polish remover which is essentially the same thing. We would include it in the kit but its volatility makes it dangerous to ship. Use liberal quantities of the nail polish remover in a pot to rinse the brush and any other equipment clean so it can be used again. Alternatively, wrap your brush in some plastic film and keep it in the freezer. The low temperature will prevent the resin from curing so that you can simply defrost it and use it next time you're laminating!

Stage 4 – Cut the Carbon Fabric

We are now ready to start working with the carbon fabric itself. If you haven't already done so, carefully remove it from the tube and lay it out on a clean flat work surface. Never lay fabric onto a work surface with any dust, uneven or rough surface or contaminants on as this is the easiest way to ruin a product. Dust or dirt will cling to the fabric and be visible on the surface of your part and a rough surface (such as one with resin spatter or splinters on) can snag the fabric and distort it.

Work out how much fabric you will need to cover the surface of the mold. You can do this beforehand using a paper template for complicated shapes or for simpler shapes we can make a guess, always aiming to be slightly oversize as a margin for error.

Stage 5 – Lay Carbon Fabric into the prepped area

Drape the fabric over the tacky surface. Keep working your way out gently until the fabric has been laid flat down onto the whole surface of the area.

The 2/2 twill fabric included in the repair kit is especially good at draping round contours and can be manipulated to follow most shapes without the requirement for cut lines. If you can't get the fabric round without cutting and jointing it then it is acceptable to cut and overlap the fabric as required but avoid this where possible for the sake of the cosmetic appearance of the part.

Stage 6 – Wet-Out Fabric

You are now ready to ‘wet-out’ the dry fabric using the some more mixed epoxy hardener and resin. Use the same ratios of hardener to resin and mixing technique described in Step 2. You will need at least twice as much resin for this next step as you used for the surface coat.

Again, using your 1” laminating brush (either cleaned with acetone/nail polish remover or stored in the freezer) start to apply the mixed resin to the dry carbon fabric. Aim to apply just enough to thoroughly wet out the fabric.

Use the brush to press the resin into the fabric, don’t use it like a paint brush as this might drag the carbon fiber with it and distort the weave on the surface. Continue this stippling action to work the resin well into the fabric. Don’t be afraid to use your finger to press the fabric into any corners or contours as seems necessary.

Stage 7 – Drape the area with release film



Using the release film to stretch across the repair area to give a nice smooth finishing surface of the part. Masking tape usually helpful to stretch the film.

Stage 8 – Tidy Up and Leave to Cure

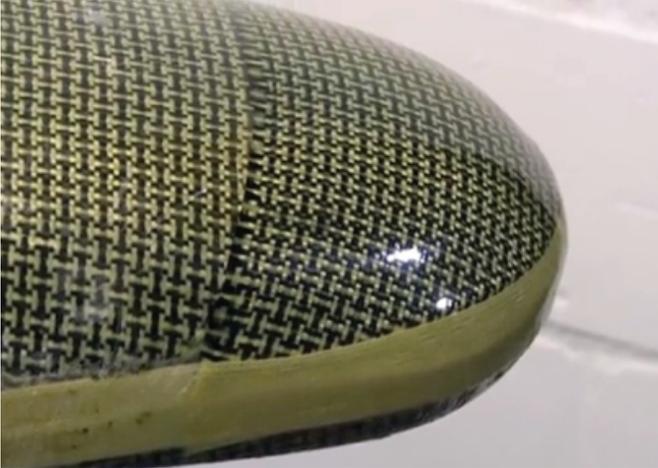
Once you’re happy, set your part on one side somewhere safe to cure fully.

Typical curing times will be around 8hrs at an ambient room temperature of 70°F. For colder conditions allow anything up to a full day or until the part feels fully hardened to the touch.



Use acetone or nail polish remover on your scissors after you have cut wet fabric with them to remove any traces of resin before it has a chance to cure.

Stage 9 – Release Part



Don't ever attempt to release a part until it is fully cured, doing so will almost certainly damage the part.

Once you're confident that the part is fully cured and ready to release (have a good tap at it with your nails) then remove the release film.

Polishing and Care

Because the part was made by using a clear layer of resin as the surface coat before any carbon was put down, there is a thin layer on the part that can be polished without breaking through to the carbon fibers. This means that degree of rubbing back and polishing can be performed on the part to bring it to a high gloss.

Fine polishing paste and rubbing compounds can also be used to polish the finished part and automotive car polishes and waxes are all perfectly safe to use on your part for the ultimate shine. UV resistant clear coat is also recommended for double protection of your shiny project.

