How to Repair Fiberglass Parts

A general guide to help in making a good repair.
Fiberglass Repair

• Repair quality is always highly dependent on the skill of the repairer.
• Keep in mind these are instructions and recommendation.

One other critical point before we begin: **NOTHING is more important than the temperature of the materials, the part and the work area.**
Everything must be above 70°F.
This presentation is divided into 5 parts:

• Identification of the defect and how deep is it
• How to prepare for the repair
• How to do the steps necessary for a repair
• What steps to do
• What tools are necessary and were to obtain them
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Part 1: Identification
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• If a defect can not be seen standing three feet away consider leaving it as long as it is not safety related.
• Most people will not see it while a repair may be even more noticeable.
• First visually inspect and identify the defect to be repaired and how deep it is.
• You must repair the cause of the defect and not just cover it up or it will reappear.
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The depth of the defect determines how the type of repair you must do.

Depth of defect - repair
Less than 1/32 inch – gel repair
Less than 1/16 – putty
Greater than 1/16 - laminate
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Surface Defects

*Is it only on the surface - stain, dull or discoloration?*
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Defects in the Gel Coat Only

Is it in the gel coat- mar or scratch?
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Defects Into the Laminate

*Is it in the laminate - gouge, crack or blister?*
Cracks
With all cracks determine the cause and take steps to prevent in the future. You must repair the total depth of the crack and not just cover it up or it will reappear.
Cracks can have different causes. Their shape tells you why they happened.
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**Spider Cracks**
Caused by a blow from the back side

**Circle Cracks**
Caused by a blow from the front side

Note: most spider cracks require a laminate repair.
Stress Cracks
Caused by bending perpendicular to the length of the cracks.
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Mud Cracks
Caused by thermo shock or corrosion.
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To determine the depth of the crack:

1. Rub with ink
2. Wipe with solvent
3. Sand slowly until black lines are gone
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Blisters can occur at different depths:
• Determine the size and number of
• Determine where they started by breaking open or sanding off several blister
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Blister Under the Gel Coat:
Problem is in the gel coat layer only
If there is no laminate on the back side of the blister cap but laminate where it was, problem is in gel coat layer or what is between them.
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If there is laminate on the backside of the blister then problem is in the laminate.
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To repair blisters properly you must:

• Remove the starting point of the blister
• Get to solid good laminate before making the repair
• Laminate must be dry
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Part 2: Preparing to do a Repair

As with most tasks, success is dependent on good preparation.
Preparation before starting a repair:

- Most of the materials used for fiberglass repairs cure or harden by a chemical reaction.
- To achieve a good repair these reactions must be run properly.
- Use fresh gel coat, resin, glass, catalyst and materials.
- Make sure all equipment is working properly.

Note: An older boat will have weathered and a tinting kit may be necessary. If working on a older boat lightly sand and buff a area to see the true color.
These reactions are greatly influence by:

- The material, part and work area temperature. They must be above 70°F.
- Avoid working in direct sun light as it will shorten working time.
- The mixtures must be accurately measure out (grams, milliters, cc’s or ounces).
- For polyesters the catalyst levels should be no lower than 2% or higher than 3%.
- Gel coat must be applied at least 18 mils thick.
If you use heat to speed up a patch:

• Never heat a repair over 120°F as distortion will occur.
• If you cannot hold your hand on the heated area it is too hot.
• If you use heat place your hand next to the repair area and you have to pull your hand way, stop heating.
• You will not be able to keep your hand on a part which is over 130°F.
Part 3: Repair Procedures

- Grinding
- Drying
- Sanding
- Puttying
- Laminating
- Masking
- Gel coating (dob or spray)
- Buffing
- Waxing
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Repair Procedures:

• Do only the steps necessary.
• Keep the repair as small as possible.
• This will require less work and make it harder to detect.

Inspect 3 ft Away
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If the defect is just a stain or discoloration:

• Wash with soap and water first.
• Then try washing with a solvent.
• Then try rubbing compound.
• Sanding is the last resort.
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The next procedure is to grind or sand out all the damage material until a good solid surface is reached.
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For small defects:

- **Gel coat:**
  - Sand out with 220 or 320 grit sandpaper

- **Laminate:**
  - Grind out with a small pencil bit
  - Use a small sander with 50 or 80 grit sandpaper
If the defect is large or a number of small defects:

- Grind out with 50 or 80 grit sandpaper.
- A single crack can be ground out with a pencil grinder.

Note: All sandpaper grits are to USA ANSI standards. Imported papers with the same grit number may be coarser.
When every possible the ground out area should be oval or round in shape as square or rectangular areas are harder to blend in.

The edges of the ground area should be beveled. Sharp edges create weak points and may show print.
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Remember, keep the repair as small as possible.

**Defect**

**Okay**

NO - creates a lot of extra work
To get a durable repair it must be able to bond to the part:

- Requires surface preparation and sanding.
- Properly prepared surface is dry, free of oils, dirt and other contaminants.

Note: The sanding techniques covered here also should be used to sand laminates and gel coat repairs.
Sanding:

- Always use a sanding block (hard or flexible) when hand sanding to prevent grooving.
- Hand sand in only one direction per grit. Then sand at a right angle with the next grit. The last sanding step should be in the horizontal direction.
- Always clean between grits by wiping the surface clean with a high performance cloth.

Note: Rags push dirt around and the bound edges may cause scratches in the surface.
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To make sure what you are sanding is flat and you have removed the sanding marks from the previous grit of sand paper use a dye guide like Dykem layout fluid (red or blue) diluted with rubbing alcohol.

Wipe on a thin coat and let dry. Then sand until all the color is gone.
If you must remove a large amount of material from a high point, surround the area with two to three layers of masking tape, sand with coarse grit until masking tape is cut, and remove the tape and sand with a finer grit paper.
If you use a finish DA (dual action):

- Use it at the air pressure recommended by the manufacturer.
- Standard DA’s create deep scratches that are harder to remove.
- Always start DA’s on the part and stop it off the part.
- Keep the DA flat to the surface and let it do the work (light pressure only).
- Skip no more than two grits when using a DA.
- Carpet pieces can be used to clean the DA paper for longer disc life.
- DA’s are not for sanding sharp contours.

DA speed should be 10,000 - 12,000 RPM

Lower speed – less cutting.
Higher speed – burn paper
If just doing a gel coat repair:
• Sand with 220/320 grit and dust off

If doing a spray patch:
• Sand area slightly larger than repair to assure bonding of edges of spray patch and dust off

If doing a laminate repair:
• Rough up the area 3 to 4" larger than repair with 80 or 120 grit and dust off.
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If the defect is greater than 1/32 but less then 1/16 of a inch deep you can do a putty repair.

Always use a marine grade putty. Do not use automotive putties as they are weak and can cause blisters.
If you make your own patching mixture:

• Use only marine grade materials.

• Do not add wax solution or PATCHAID® if another material will be applied over it later.

• Gel coat can be thickened by mixing in 2% fumed silica (Cabosil or Aerosil).

• Use a high shear mixing blade.

• Measure out at least 50 grams of putty and add 1 or 1.5 gr., ml’s or cc’s of catalyst.
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Normally gel coat is sprayed over a putty patch as the fillers or glass change the color.

Sand the putty repair with 220 or 320 grit dust off and do a gel coat repair.
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Always measure properly.
If the defect is greater than 1/16” deep, a laminate repair is required.

If the laminate repair is large or affects the structural integrity, consult the manufacture for proper types and amount of glass and resin to be used.

Note: resin to glass ratio is very important to achieve proper laminate strength.
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Grind out all damaged laminate until solid good laminate is showing.

The area ground out should be oval or round. Avoid square or rectangular cuts outs as the cause weak points.
Bevel edges around damaged area outward for at least 2 inches to assure a good bonding area.

Determine the layers of glass to be used, cut to size, shape and weight. Cut the glass to form a pyramid rather all the same size.
Fiberglass Repair

For the type and weight of the glass:

• Calculate the proper amount of resin necessary for the proper ratio.

• Measure out (gr., ml’s, cc’s or ounces) slightly more resin than this and catalyze at 1 to 2% or per manufacture recommendation.

• With catalyzed resin prewet the repair area then place one layer and roll out the air. Then follow with any other layers adding resin as necessary.

• The final part should not have any air, fiber sticking out or a glossy backside (resin rich-brittle). You should just be able to see the outlines of the fibers.
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Too much resin gives a weak brittle part (glossy on the back side).

Too little resin gives a weak part (whitish areas on back side).

You want to just see the outline of the fibers.
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Allow to cure and sand smooth with 220 or 320 paper.
Make sure there are no fiber sticking out of the laminate.
Dust off and do a gel coat repair.
If a hull or blister repair use epoxy, vinyl ester or isophthalic type resin resin with a minimum of 18 mil thick gel coat covering.
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Masking:

• Always mask on to the sanded areas.

• Were possible mask to a visual break point (a gap, fitting, stripe or curve).

• Use the back tape type of mask to help give a feather edge when doing a spray patch.

• Or use automotive blend tape.
Fiberglass Repair

Back Taping:

• Press one edge of tape down and roll the other edge back over to form a loop.

• Do not flatten the tape.

• Or put the tape on masking paper and do the same thing.
Now you are ready to do gel coat repairs. Gel coats are designed to spray into mold and the backside remains partially cure until the laminate is applied. This means gel coat repairs will be sticky on the back side unless sealed or wax solution/Patchaid® is used.

*Note: do not add wax solution or Patchaid® to clear gel coats as cloudiness can occur.*
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For small repairs, the gel coat can be dabbed in. It is critical when doing a gel coat repair to accurately measure the gel coat and catalyst. The smallest amount for that one can do accurately is 50 grams, milliters or cc’s.
Fiberglass Repair

Do not use drops as a way to measure, as it is highly inaccurate.

Do not use paper or Styrofoam® cups or wood stir sticks. They will absorb the catalyst or dissolve.

*Note: always measure in gram, ml’s, cc’s or ounces.*
If using gel coat by itself, cover the patch with wax paper, plastic or PVA.

If using wax solution add 2% or the recommended amount.

If using a Patchaid® add 30% or recommended amount.

Measure out 50 grams, ml or cc’s of the gel coat mixture.

Add 1 gram, ml or cc of catalyst.

Note: This is the smallest amount of these materials that can be accurately measured.
Fiberglass Repair

• Slightly overfill as gel coat shrinks as it cures.
• Once cured (you should not be able to dent with finger nail) buff as if polishing. The slight heat generated will make sure all shrinkage has occurred before sanding.
• Do not allow to get so hot that you cannot keep your hand on the part. If over heated too much distortion will occur.
• Sand with 220/320 and finish with 400/600 wet or dry paper (DA use 320/500/800).
• If hand sanding always use a sanding block.
Larger areas will require spray patches.
Mix a minimum of 35 gr., ml’s or cc’s of gel coat with 15 gr., ml’s or cc’s Patchaid® and 1 gr., ml’s or cc’s of catalyst or per manufacture’s recommendation.

Standard is 70 parts gel coat, 30 parts Patchaid® and 2 parts catalyst.

Do not reduce with acetone or solvent.

Spray with Binks 115 or DeVilbiss EGA gun.

Feather the edges of the spray repair.

Allow to cure, pre-buff, and sand with 320/400, then 600 wet or dry (DA use 320/500/800).
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After is sanding, buffing or polishing is next:

• Use a buffer with a 1400 to 2700 RPM speed.
• Always keep at a low angle to the part.
• Do not use too much pressure or the edge as it will create too much heat.
• If you have to use high pressure to remove scratches you did not sand enough.
• Start with medium pressure and lighten up to finish.
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• Always use a clean pad.

• White wool pads are for cutting with medium to heavy rubbing compounds.

• Yellow (softer) pads are for fine or finishing and glazing compounds.

• Season a new pad by buffing a scrap part to remove knots. Do not buff on /or use wood to clean a pad.
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• With rubbing compound work only a 2’ X 2’ square.
• When using finishing compounds work only a 1’ square area.
• Manually spread the compound in this area only pushing it into the scratches.
• Always cover the pad when not in use and do not place face down as it will attract dirt.
• Always wash part with soapy water after buffing to remove residue (solvents are not recommended).
After buffing the part should be waxed:

• Always wash with soap and water to remove any buffing compound residue.
• Always apply a wax that is UV stabilized.
Part 4: What steps to do.

Defects on the surface or just in the gel coat

• First wash with water or solvent.
• If necessary use fine rubbing compound.
• The last resort is sanding as polish is then necessary.

If rubbing compound is use soap and water wash followed by waxing
## Defects which go through the gel coat

<table>
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<tr>
<th>Depth</th>
<th>Grind out</th>
<th>Mask</th>
<th>Putty</th>
<th>Laminate</th>
<th>Gel coat</th>
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<tr>
<td>Less than 1/32</td>
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<td>Yes</td>
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</table>

Buffing, washing and waxing is required after all these repairs
Part 5: Tools

Sand paper, sanding blocks, rubbing compounds, masking paper, masking tape, spatula, spray gun, buffer low RPM, DA sander and grinding tools may purchased from a marine or industrial supply distributor.
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Measuring Devices:
Mixing cups, disposable transfer pipette, graduated cylinders, balance or scale may be found in the yellow pages under laboratory equipment and supplies.
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Materials:

• Solvents may be purchased from marine or industrial supply distributor.

• For putty, gel coat, resin, fiberglass, catalyst, and patching additives contact part manufacture or distributor, such as Composites One.

• Small amounts and tinting kits can be purchased from: Spectrum Colors, 1410 th St. N. W. , Auburn, WA 98001. Phone: (253)735 1830
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**Metal Flake Repairs:**

Grind out defect until good laminate.

Mask off area.

Fill with mixture of glass and resin – roll out.
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Sand laminate and fill any holes with putty and sand if necessary.

Tape off using several layers of tape such to just expose just enough area to do each gel coat application and still be able to feather each application.
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Spray base coat – usually black.

Remove one layer of tape to widen out patch for next layer – no wait between layers.
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Make a 50 50 mixture of clear and clear thinner. Then add metal flake and spray.

To spray the older large metal flake use a gun with a metal flake needle or a dump (R2 plaster gun).

The newer small metal flake can be sprayed with the touch by gun - remove the needle knob and spring to allow large opening.
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Feather out the spray and remove the next layer of tape.

Make a 50 50 mixture of clear and clear thinner and spray – no wait.
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Remove tape.

Spray a light mist of catalyzed patch over the clear.
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Remove final tape and allow to cure. Then sand carefully and buff out.