# JTOWN FIBERGLASSING STEPS

## QUICK REMINDER:

**POLYESTER (THE PINK COLOUR STUFF) RESIN to HARDERNER RATIO:**

- The most common resin mixture. Use this in all repair situations, unless experienced with other resins.
- 6-8 Drops of Hardener to One ounce of resin. This will provide about 15 minutes of working time with the resin.
- More hardener for colder weather (10C-15C). Use double the ratio.
- If above 25C use less harderner. Half the ratio is a safe mixture

**EPOXY RESIN (WEST SYSTEM in metal square cans):**

- Only use this if you have a specific issue requiring epoxy, this stuff is very strong and hard to sand. Mostly used for major repairs and strengthening.
- See instructions on West System bottles.

# FULL STEP BY STEP

## Structural Repair

### ***1) The first step is to inspect the damage, identify the materials involved, and determine whether the part should be replaced or repaired.***

Damage to composite materials usually falls into four categories, but all can occur from a severe impact. Tears, holes or punctures, crushed cores, and delamination are the most common problems. To make reference quicker, use a marker to outline the boundary of the damage. Close inspection is necessary as the problem area often extends farther than can be easily detected visually. A coin tap test is an effective way to test the surrounding area. An audible difference is easy to detect between solid laminate and crushed material when tapped with the edge of a coin.

Identification of the materials involved, especially the resin, can be more difficult. Begin by determining the type of fiber reinforcement used. This will often give clues as to the type of resin employed. Marine applications where chopped mat is most prevalent probably used general purpose polyester resin .

Once the extent of the damage and the type of composite used is known, the next step is determining if the part should be repaired or replaced. If no information can be reviewed, make a quick estimate of the materials and labor time needed for the repair and compare the figure to the price of a new part. If it's going to save you less than 50% by repairing, you might want to just replace the part altogether.

## ***2) Remove the damaged material and prepare the area for bonding.***

When a part is broken or crushed it is difficult to realign the pieces with each other because the frayed fibers tend to "hang up" on one another. Use a saw blade to cut the length of cracks or tears. This relieves the stress on solid laminates, which often return to their original shape with little force.

Cored parts tend to pancake and mushroom, further complicating realignment. A router is excellent for removing damaged core material without disturbing intact face skins. Always try to remove as little material as possible so the repair does not grow too large. However, solid laminate must be exposed for a good repair. Continue coin tapping and grinding until all the damaged material is removed. Finally, determine the density of the core so it can be replaced with the same material.

Next, support the part so nothing gets distorted during the repair process. This can be as simple as strips of 2 inch wide masking tape, or as elaborate as a custom-made clamping fixture. Generally, high-performance parts require very precise support systems.

With the part supported, proceed to preparing the bonding surface by grinding a taper or steps around the damage. This is the critical step for functional repairs, but it is also the most overlooked and abused. If a taper is to be used, measure the depth of the valley and calculate how far the sanding must extend to achieve the desired ratio. Mark the outer edge of the taper using a marker, and begin sanding inward toward the valley. Be sure to remove material slowly so the taper progresses evenly. Write down the orientation and type of fabric used as each layer becomes exposed so it can be replaced in the same way.

For personal safety and cleanliness, tape the hose of a shop vacuum to the work surface so dust can be removed while grinding is taking place. When the sanding is complete the whole surface needs to be thoroughly cleaned. Vacuum any remaining dust and then wipe the surface with a solvent rag. Acetone is usually

sufficient for removing oils, greases, dust, waxes, or other contaminants which would interfere with repair adhesion.

## ***3) Laminating the repair patch.***

Begin this procedure by precutting the core replacement and the reinforcement plies that will fill the repair taper. Cut the core first to fill the deepest hole. Cut each ply so it fits precisely into the step that was prepared for it. Modern repairs are made ply-by-ply, so the smallest piece is intended to go into the bottom of the valley. Stack the reinforcements near where they will be used, with the first layer to be placed in the bonding area on top of the pile.

Remember we have two types of resins, Polyester (pink liquid in clear plastic bottle) and Epoxy (West System) in metal cannisters. If in doubt use the polyester liquids. West system is very hard to sand and shape and is expensive, normally used to reinforce special situations.

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**EPOXY RESIN (WEST SYSTEM): See instructions on West System bottles**

Mix the appropriate resin or adhesive system for the repair patch. Pre-weight the reinforcement schedule and mix only the same weight of resin. This will keep the resin content within a reasonable 50:50 ratio. Pre-wet the entire bonding area with resin, then begin saturating each ply of reinforcement before it is placed into its step. Work on a sheet of plastic so the fabric can be easily lifted from the table once it is ready. A flexible rubber squeegee is the best tool for spreading the resin evenly through the fabric and removing excess which may be present. Place the reinforcement into its spot on the repair, ensuring the proper orientation. Stop every few layers to compact the patch as much as possible. A squeegee or grooved roller works well for this. Continue stacking the repair plies until all the fabric that was removed has been replaced. A final cover layer is then added over the entire area.

Plan on compacting the final repair patch as densely as possible while the resin is curing. Vacuum bagging is the most uniform method, but squeegees, rollers, or other clamping pressure will work adequately. Follow the manufacturer's recommendations for curing the resin or adhesive. If a two-sided repair has been planned, preparation of the opposite side can begin once the first patch has cured.

## ***4) Inspect the repair before putting the part back into***

### ***service.***

Use the coin tap method to inspect the cured repair. The entire structure should resonate the same solid sound. Non-destructive load testing can also be used for greater confidence. This consists of stressing the part up to its expected service limit but not beyond. If the part fails prematurely, it should be discarded. For more critical structures, a testing laboratory or specialized equipment may be necessary before sign-off. If all is well, proceed to the cosmetic repair sequence.

## Cosmetic Repair Sequence

The cosmetic repair sequence is similar to the structural sequence, but filler or gel coat replaces any reinforcing material. Surface preparation is still the most important aspect of a long-lasting repair. Finish sanding and polishing are the only differences, but they make a good job look truly professional. Many fear tackling cosmetic work because they think it requires expensive spray equipment for satisfactory results. Equipment is important, but proper material selection will give better results.

### ***1) Inspect the damage and remove any other loose or unsupported surface material.***

Inspection of cosmetic damage is just as important as it is with structural repairs. Gouges often leave undercut areas of unsupported gel coat which at first appear fine. Press on them with a blunt tool and they will easily crack away. Every such area must be identified so it can be prepared correctly in the next procedure. Use a marker to circle each spot that needs prep work. This is especially important on large blister repair jobs. Once the dust starts to fly, it isn't always easy to see the surface!

### ***2) Prepare the surface for the addition of gel coat or filler .***

Begin by taping off the area surrounding the damage. This will keep sanding scratches around the damaged area to a minimum. Next, wipe the surface with acetone and a clean rag to remove any wax, oil or grease which might contaminate the repair. When this dries, chip out all the loose material with a knife, then use 40-grit paper to bevel the edges to a taper. The scratches should reach down into the crack or hole for better bonding strength. Even thin cracks will have to be "opened up" before material can be added to fill them. Blisters will have to be completely exposed at this time. Also, be sure the remaining laminate is solid and dry. Wipe down the surface one more time to remove dust and anything else which may disrupt adhesion.

## ***3) Mix and apply the appropriate cosmetic filler material.***

Shallow scratches can be directly filled with color matched gel coat. Be sure to match the gel coat to a sanded and polished portion of the original, not the overall faded color. The repair may stand out at first, but everything will fade to the same color in about a month. Use a small brush to dab in the gel coat. Be sure it is higher than the surrounding surface so it can be sanded flush. Spray a light coat of PVA over the repair for a tack-free, sandable cure. Using clear library tape over the applied gelcoat can save future sanding if the repair is small.

Deeper gouges will require structural putty filler to replace the missing material before the gel coat is applied. 1/32 inch milled glass fibers in resin make an excellent structural putty. Use a squeegee to spread it into the bottom of the gouge. Keep this filler slightly below the surrounding surface if gel coat is the intended top coat. When painting, the filler can be level with the surface because paint adds little thickness. When filling hull blisters, be sure to use vinyl ester resin to make the milled glass putty. This will add extra corrosion protection to these weakened areas.

If the cosmetic repair is following a structural repair, it may be necessary to level the structural patch with the solid laminate. Both grinding and filling may be necessary to accomplish this. Grind all high spots until they are flush with the rest of the surface, unless this will compromise the structural strength of the patch. Use filler to level any low spots. If grinding cannot take place for structural reasons, fillers can be mildly added to smooth irregularities, but the patch will always be visible. On marine repairs, use the 1/32 inch milled glass putty filler described previously. Continue adding filler and sanding until the surface is perfectly flush.

## ***4) Mix and spray the color matched top coat.***

If gel coat is the intended top coat, it is necessary to mix the gel coat with a Hi-Gloss Additive . The additive will allow a full surface cure, reduce orange-peel and later sanding. Below-the-waterline repairs on marine projects need to use a surfacing agent like PVA or wax (Air Dry) to ensure a thorough cure. Wax is excellent on large, hard to reach areas, but it can cloud clear gel coats. PVA is the best for spot repairs where access is easy while the gel is still wet.

Gel coat will need to be finish sanded prior to final buffing. Use a hard rubber sanding block and 400 grit wet/dry paper to level the gel coat. Focus the sanding effort only on the high spots until everything is flush. Then, switch to a foam sanding pad and even finer paper for the perfect finish. Be sure to change water when the paper is changed so the dust particles from the coarser paper do not continue to cut the surface.

## ***5) Polish the repair area to the desired luster.***