

# Repair Manual

Martin Marietta Composites  
Rail Division

*Insulated Door Liner*

# COMPOSITE DAMAGE REPAIR

## Introduction

Martin Marietta Composites (MMC) FRP parts are formed from laminated sheets of fiberglass mats held together with synthetic resin. When the liquid resin mix cures or hardens, it binds together the filaments of glass in the mats to create a solid panel. The strength of the panel is provided by the glass fiber while the resin merely acts as a bond.

In general, all repairs to fiberglass parts and fiberglass parts with foam insulating core consists of: (1) removal of damaged material, (2) filling any missing insulating foam, (3) filling the damaged composite area with resin and glass, (4) allowing the activated resin to cure (harden).

## FRP COMPOSITE REPAIR

*Damage: Resin surface scratched or otherwise removed and glass reinforcement exposed.*

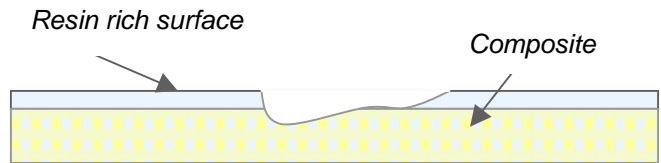
### Sealing Repair Procedure

1. Sand the damaged area. Remove the dust and clean as required.
2. Verify that the area to be repaired is free of moisture to insure proper adhesion of the sealant.
3. Catalyzed resin, paints (polyester, epoxy, or polyurethane), Acrylic lacquers, or oil base paints can all be used as a sealant. All of these products will effectively seal the surface. Carefully follow the manufacturer's instructions for the use of these products as they are toxic, and harmful vapors may be generated when curing.
4. Cure the system and carefully sand excess sealant. Vigorous sanding may reopen the sealed surface and require a repetition of this procedure.
5. Many users paint the FRP structural profile to enhance the surface appearance. Structurally, the synthetic veil enables FRP members to suffer only minimal damage due to ultraviolet radiation; however, some fading of the surface pigmentation will be observed. This surface fading can be minimized by painting.

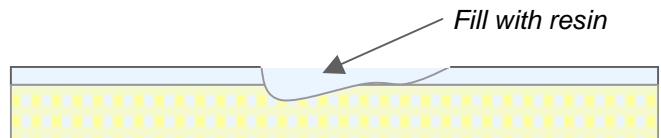
*Damage: Minor surface damage such as chipping.*

### Resin Filling Repair Procedure

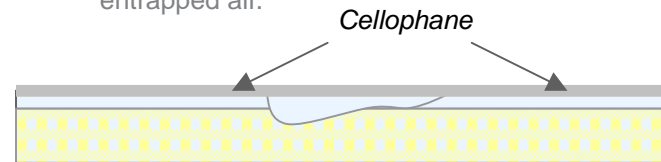
1. Sand the damaged area to remove all loose material and to provide a good bonding surface. After sanding, the damaged area must be cleaned and dried.



2. Epoxy or catalyzed resin may be used in this repair. If epoxy is used, the mixing procedure of the previous section is applicable. If catalyst resin is used, follow the manufacturer's recommendations. (The exact ratio of catalyst to resin can be altered to improve pot life). If so desired, mill fiber, Cac-o-Sil, or another filler may be added to improve the workability of the filling paste. Pigment can be added to match the color of the section to be repaired. **Note:** If the resin/catalyst combination begins to "smoke", the ratio of catalyst to resin is too high. Make a new mix of resin using less catalyst.
3. Using a spatula or putty knife, fill the damaged area.



4. Cover the repair with cellophane and press together, massaging the repair area to remove entrapped air.



5. Tape the cellophane securely into position protecting the repair while the resin cures. Allow twenty-four (24) hours for proper curing.
6. After twenty-four (24) hours, remove the tape and cellophane and carefully sand the repaired area. Complete this repair by employing the Resin Sealing repair procedure.

*Damage: burn*

*Contact MMC engineering to determine which procedure to follow.*

*Damage: small crack and the structural integrity is not threatened*

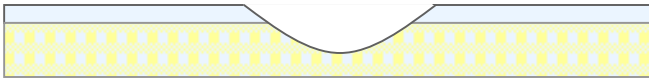
*Resin rich surface*



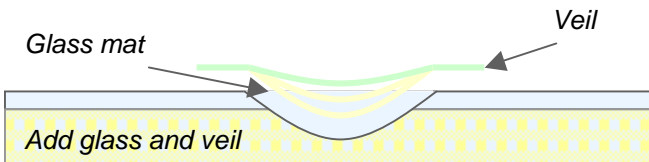
### Glass Lay-up Procedure

1. Grind and sand the damaged area. Taper both sides of the damaged area approximately 2" to 3" above and below on either side of the crack.

### Sand to smooth area



2. Remove all dust and clean.
3. Cut a piece of glass mat to cover within one half at the edges of the sanded area.
4. Cut a piece of 10 mil veil to cover all of the sanded area (2 or more pieces may be required).
5. Weigh the glass veil and mat. Weigh four (4) times that weight in resin and add catalyst per the manufacturer's recommendations. Stir thoroughly. The pot life of this mixture is dependent upon the % catalyst and the ambient temperature and must be determined on site. **Do not** attempt to use catalyzed resin after it begins to gel (becoming like jello).
6. Paint the sanded area with this resin/catalyst mixture.
7. Apply glass material and thoroughly wet with the resin/catalyst mixture.
8. Add layers of glass materials and resin mixture to obtain the desired thickness.

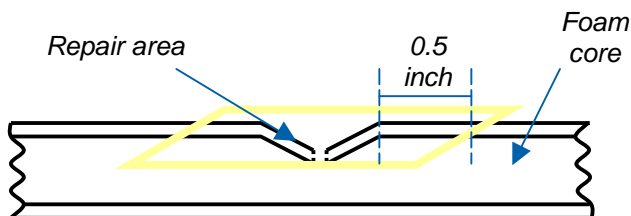


9. Cover with cellophane and tape perimeter. If necessary place a plate over cellophane, so entrapped air can be removed. Remove when the repair is cured.
10. Sand to a smooth finish and coat with resin mixture for corrosion protection.

### COMPOSITE- PANELS with foam cores

#### Damage: minor damage to foam core

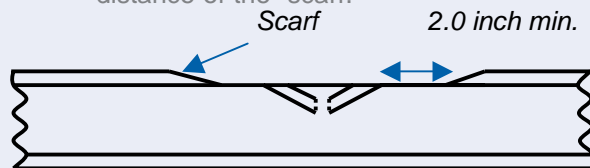
1. Inspect the damaged panel. It may be necessary to remove paint for a better visual inspection.
2. Determine the area to be repaired. Generally repair an area about one half to one inch larger than the damaged area.



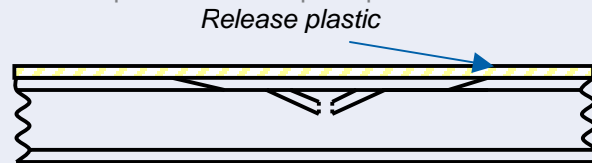
3. Clean the area around the repair with acetone or isopropyl alcohol (IPA).
4. Once the area is ground as shown below, again

inspect the area to verify the damage is removed.

5. The "scarf" area should be a minimum of two inches all around the damage.
6. Cut plies of the same fiberglass used in the construction of the panel to the shape of the repair. Take into account the ply location in the stack up. The outside layer should be about the same size as the prepared area. The inside layer should overlap about 1/3 of the "scarf." The middle layers should divide the remaining distance of the "scarf."



7. Mask the area around the repair to ease the cleanup.
8. Clean the repair and area around the repair with acetone or IPA.
9. Use the proper resin and catalyst and wet out the repair area.
10. Start with the inner ply and lay it in place. If a weave is used care must be taken to lay it in the proper orientation. Wet the layer with resin. Finish all the layers.
11. Lay a piece of release plastic over the repair area and tape in place.



12. Remove all the air from under the release plastic.
13. If possible clamp a plate over the repair. The plate will ease the clean up.
14. Once the patch is cured clean up all the excess resin. If material needs to be removed care must be taken to not harm the panel or the repair.
15. If the panel is to be left unpainted wipe any sanded area with catalyzed resin or finish with paint.

#### Damage: more severe damage to foam core

1. Inspect the damaged panel. If the panel is painted it may be necessary to remove the paint for a better visual inspection.
2. Determine the area to be repaired. Generally repair an area about one half to one inch larger than the damaged area.
3. Clean the area around the repair with acetone or IPA.

4. Remove all loose foam core material.
5. Replace the foam core material by spraying foam into the missing area until fully filled. Spray foam such as RRH Foam Systems, Inc. or similar can be used.
6. Use a hacksaw blade to cut the filled foam flush with the composite surface.
7. Once the foam is prepared, mark the area to be “scarfed.”
8. The “scarfed” area should be a minimum of two inches all around the hole.
9. Follow the composite repair steps outlined in the minor foam damage procedure beginning with step 6.

*If any major composite structural members are damaged, notice must be provided to MMC and approval received for any repairs.*

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