

Repairs to Glassfibre Structures

Structural mouldings made from polyester resin reinforced with fibreglass (GRP) are strong, combine rigidity with resilience and are not easily damaged. However, if accidentally damage does occur, this is relatively easy to repair by the techniques described below, which are based on the hand layup or contact moulding process already described in the section 'Fabrication Techniques for GRP Structures'.

Equipment

The following list indicates the tools and other equipment which may be required for carrying out the repairs to GRP. It is advisable to make sure that these items are available before starting operations.

1. Hacksaw
2. Chisel, file or Surform tool
3. Wooden mallet
4. Electric drill with disc sander
5. Rubbing block and sheets of 240/400 grade wet and dry.
6. Tin of wax and sheets of Sellotape or polythene.
7. Set of Household scales
8. Polythene bucket and several large and small waxed paper or plastic cartons.
9. Laminating brush
10. Scissors or sharp knife
11. Extending steel ruler
12. Broad knife
13. Supply of acetone - to clean the brushes of resin
14. Measuring cylinders for catalyst and accelerator

Materials

Polyester Resin

A [Polyester Resin](#) of thixotropic type suitable for application to vertical or inclined surfaces without drainage is required. Suitable quantity of catalyst is added to the resin immediately for use. The smooth surface of the original GRP moulding has been achieved by a special [Gelcoat](#) resin and a resin of this should be used for the corresponding surface of the repair.

Glass Reinforcement

Glass fibre reinforcement ([Chopped Strand Mat](#)) for repair operations usually takes the form of chopped strand mat (CSM) which is supplied as sheet and is available in several different weights ranging from 300-900gm mt/sq. The choice of weight will depend on the circumstances for any particular repair, it being preferable to the layers in the previous GRP, if these can be ascertained.

Impact Fractures

This type of damage takes the form of a crack, which may extend to the reverse side of the laminate. The consecutive steps are:

1. The fracture should be enlarged from the surface of impact to a v-shaped groove, ensuring that all the damaged area is removed to the full depth of the crack. It may be necessary to form a tapering slot right through the laminate. (See Figure 1)
2. Sand back the surface of the original laminate for at least 75mm (3 inches) from the slot and brush off any loose powder.
3. Cut four strips of [Chopped Strand Mat](#) (CSM) of suitable weight (450gm). These should be increasing dimensions, the smallest extending 25mm (1 inch) beyond the edges of the slot and the other three being progressively larger by 12mm (0.5 inches) all round.
4. Weigh the strips of CSM and then weigh out 2 ½ times this weight of resin. Add [Catalyst](#) to the resin.
5. Working from the back of the original laminate, brush a liberal coat of activated resin over the whole of the sanded area, then lay the smallest strip of CSM in position to cover the slot and overlap uniformly all round. Apply more resin to the surface of the CSM and taking care not to push the CSM into the slot, work the resin in until the CSM is evenly impregnated. Roll carefully to remove any occluded air and repeat the procedure with other strips of CSM finishing up with the largest.
6. Allow the new laminate to cure completely. The time required will depend on the quantity of the [Catalyst](#) used and the ambient temperature, but it is usually better to leave the repair overnight.
7. When the new backing has cured, the crack is progressively filled working from the smooth, gel coated surface of the original laminate. Pieces of CSM impregnated with resin are laid in the slot and built up to within 2mm (0.08 inches) of the final surface.
8. A suitably filled and pigmented resin mix is used to fill the crack level with the gelcoat surface and when fully cured is sanded smooth.

Punctures

Where the moulding has been severely damaged and an appreciable area is involved, a better procedure for a repair is described below.

1. All jagged edges and damaged laminate in the vicinity of the puncture are cut out so as to leave a clear hole with smooth edges all round. The reverse face of the old laminate is then sanded down in the area surrounding the hole.
2. The edges of the hole are filed down to form a wedge shape shown in figure 2, for thicker laminates filing is preferably from both sides as shown, but with thin laminates it is sufficient to file from the back. The area is finally brushed to remove any loose powder.

3. Pieces of CSM of equal weights to those of the original laminate (if known) are tailored to fit the hole and patches of CSM for backing the repair are cut of progressively increasing sizes up to the limits of the sanded area.
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Fig 1 Repair technique for impact fractures.

Cut away all damaged laminate and fill with dough mixture or small pieces of pre-impregnated CSM to within 2 mm of surface

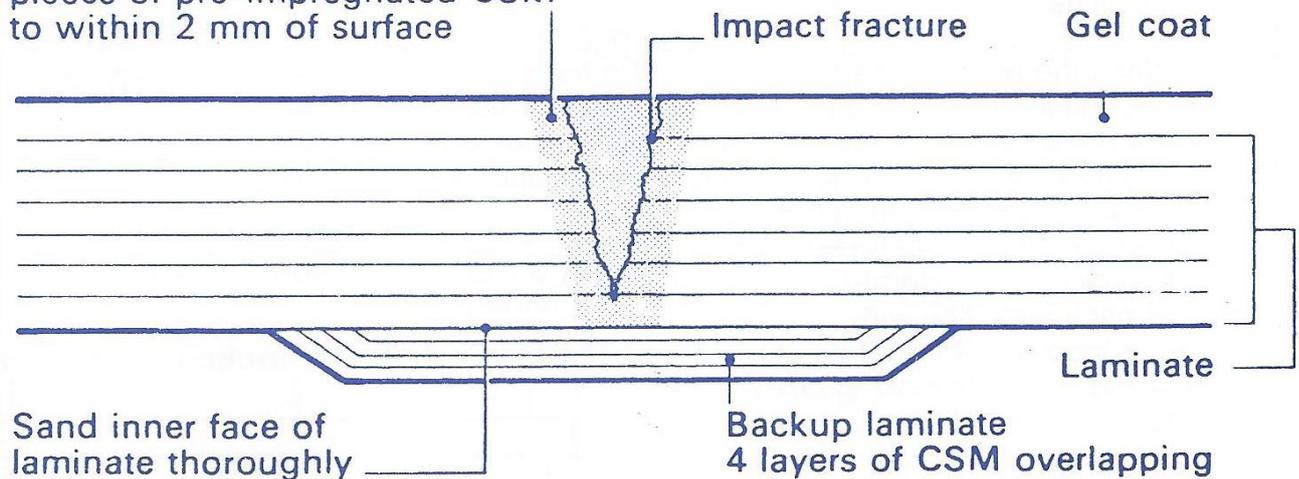


Figure 1

5. The hole must be covered on the gelcoat side of the laminate so as to provide a smooth surface flush with the **Gelcoat** on which to work. For the smaller repairs, a suitable piece of the hardboard or aluminium sheet can be used and this can be held in the position by means of adhesive tape. For larger holes on relatively flat surfaces, a piece of plywood is preferable and this can be fixed by means of bolts through the thickness of the moulding. The bolts must be as close as possible to the repair hole, but must be clear of the area to be covered by the backing laminate.
6. Before fixing, the inner face of the board is generously coated with wax polish and brushed over with a **Release Agent** of the polyvinyl alcohol (**PVA**) type. The treated 'facia' board is then fixed to the gel coat side of the laminate.
7. When the release agent has completely dried, a small amount of pigmented and catalysed gel coat resin is prepared and a generous layer is applied by brush to the inner surface of the facia board, working through the cut-out hole from the back of the laminate.
8. When the gel coat is touch dry, a previously catalysed laminate resin is applied over the gel coat followed by layers of CSM which are each in turn impregnated with resin and rolled to remove air bubbles. When the hole has been filled flush with the back of the laminate, the resin is allowed to cure, preferably overnight.

Fig 2 Repair technique for punctures.

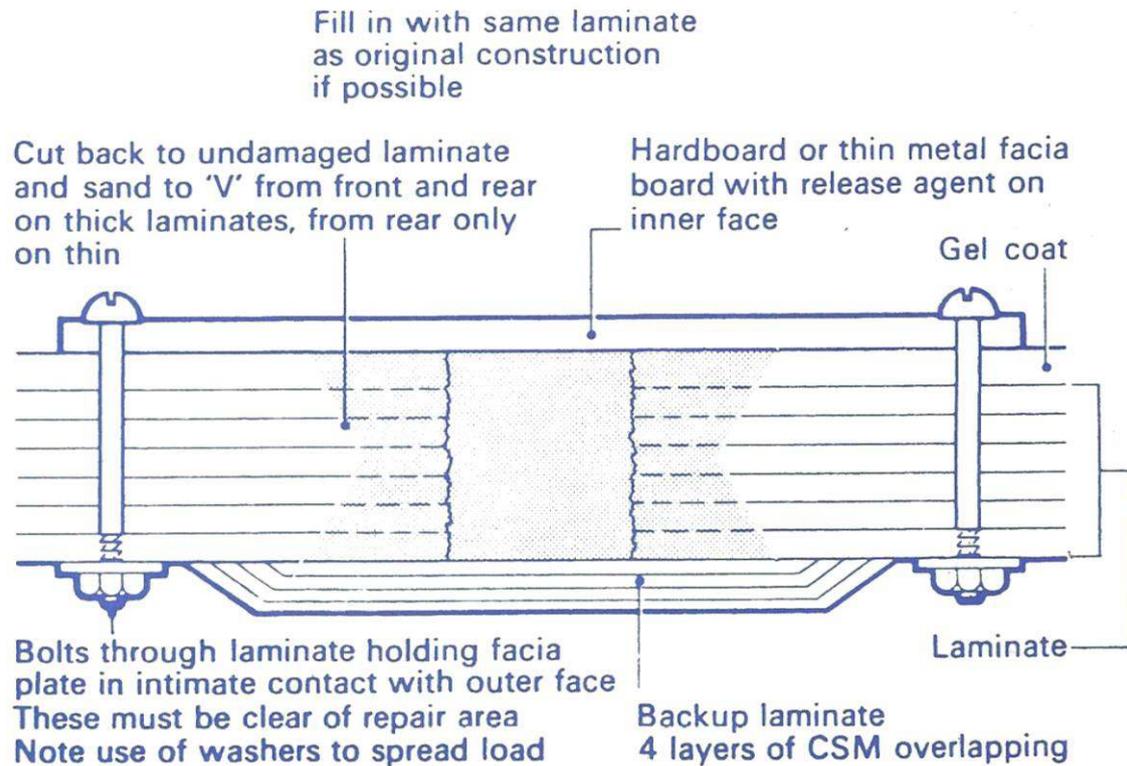


Figure 2

9. The facia board can now be removed and the holes which held the bolts filled with a catalysed resin/filler mix.
10. The final backing laminate is now built up. This consists of 4 to 6 layers of CSM and these are successively applied as indicated on the page E1 for an impact fracture, finishing with the largest patch on the final surface of the repair.
11. Any low spots on the other (gel coated) surface can be filled with pigmented resin, then sanded and finally polished. When large punctures are repaired, the final finish is not likely to be as good as that of the original laminate and this must be accepted. Better results can be achieved, if necessary, by application of a suitably pigmented polyurethane paint over the area of repair. When the large hole is, a curved surface has to be repaired, a facia board of the exact contour required can be made from GRP by use of either the original mould or an undamaged replica moulding.

Repairs on blind panels

In some cases, it is impossible to reach the reverse face of a damaged laminate, in articles of double skinned construction, for example, and in such cases, 8 special repair techniques have to be used. The procedure is illustrated in Fig 3 and involves the stages indicated below;

1. A rectangular hole is cut as to remove the whole of the damaged area and the reverse side of the laminate is sanded down by hand as far as is possible by working through the hole.
2. The edges of the hole are filed down at an angle as indicated in Fig 3, and the area is finally brushed to remove any loose powder.
3. A rectangular facia board larger than both dimensions that the cut-out hole is prepared from hardboard or plywood depending on the size of the hole. This facia board has to be passed through the cut out of the hole to the reverse side of the moulding and its smaller dimension of the hole. Two small holes are drilled in the facia plate near the centre (see insert in Fig 3).

4. Rectangles of CSM of suitable size are laid up on the facia board and impregnated with the resin as previously indicated, rolling to consolidate and remove air. Three or four layers are built up in this way, and a length of strong wire is then passed through the two holes in the facia plate and through the laminate, so that the ends protrude on the laminate side of the plate.
5. While the new laminate is still wet, the facia plate is passed through the hole and pulled tight by means of the wire so that the wet laminate is pressed against the reverse side of the old laminate all-round the hole. Tension is applied to the wire in order to do this, an easy way being to bridge the repair with a bar placed on the stand-off blocks at each end. The wire is placed in a loop over the bar as shown in Fig 3 and twisted, tourniquet fashion, to tighten it.
6. When the backing laminate has cure completely, preferably overnight, the wire is cut back as close to the laminate as possible and the repair is built up with layers of CSM to within 2mm of the gel coat surface of the original moulding. A final generous layer of suitably pigmented and catalysed gel coat is applied, followed by a layer of cellulose film, which is left in position until the resin has cured.
7. When it is finally cured, the repair is sanded and polished as previously indicated.

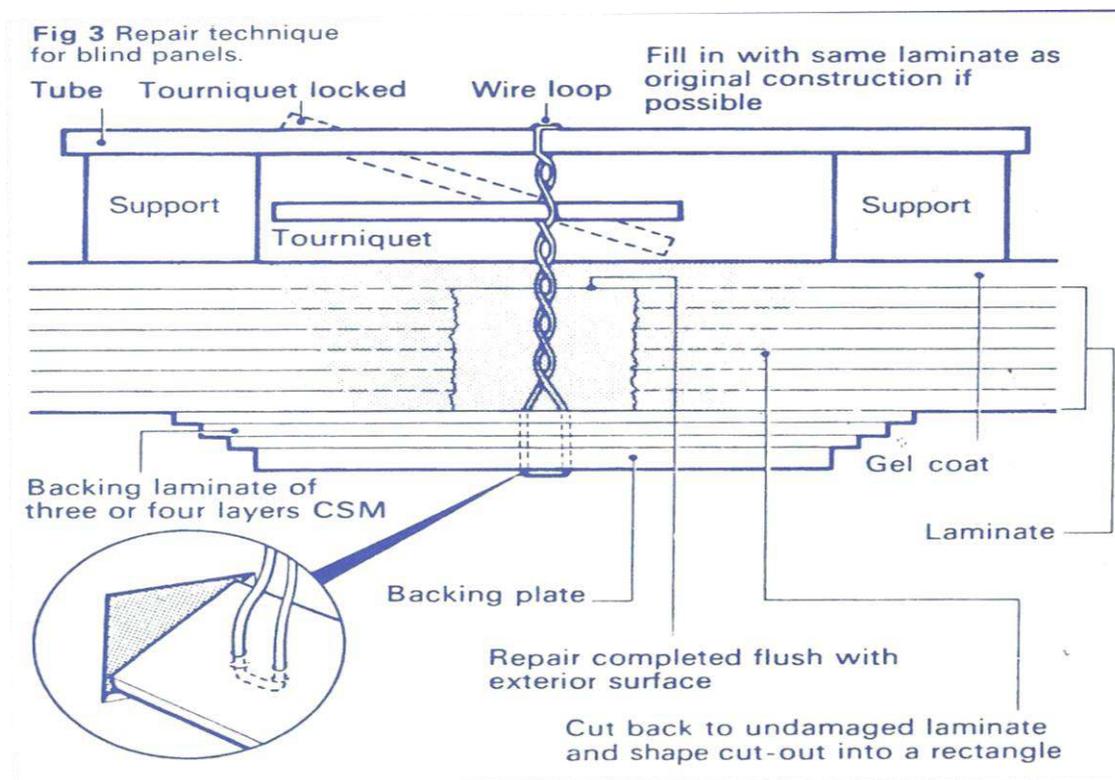


Figure 3