

# Procedure for Repair of FRP Components in LHB Coaches

## Procedure for Repair & Re-painting of FRP components in LHB coaches (Manufactured by hand laying up process)

### 1. SCOPE

This procedure is for repairing of damaged/broken/cracked FRP Ceiling Panels, Side Panel, Lavatory Panels & Attachment Walls, which are manufactured by hand laying up process. Defects may occur due to sudden impact by passenger luggage/ during maintenance of other parts in coaches or any inherent defect during manufacturing of products which has shown up late.

This procedure is applicable for FRP items manufactured by hand laying up process & should not be tried on FRP items manufactured by any other process like RTM, SMC, DMC etc.

### 2. GENERAL

FRP manufacture and repair is a highly specialised process which requires experienced manpower. On date this is not available with the Railways. It is therefore essential that experts, who are available only with the vendors supplying FRP components to Railway, carry out the repair work. The list of vendors supplying FRP components for LHB Coaches is enclosed as **Annexure-I**. Alternatively 3-5 staff of the Railway POH workshop or sick line can be given training at manufacturer's premises or in RCF. These staff during course of time will gain experience & expertise while carrying out repair by themselves.

### 3. REPAIRING WORK SITE (in side coach/outside coach i.e. Railway premises, vendor's premises,)

The location for carrying out the repair will depend on the nature of defects & their total number. It will normally be preferable to carry out the repair at site and in position to minimise the detention of the coach. However Type V (*refer para no. 5*) defects can not be repaired in coach and the panels will have to be necessarily removed for repair.

The coach offered for FRP repairing shall be arranged on sick line, where facilities like power connection, compressed air connection, availability of water etc are available.

### 4. DEFECTS ANALYSIS

4.1 The coach identified for repair shall be examined and the defects will be noted in detail

4.2 Type of defects & their location in the coach will be noted with reference to seats/berth numbers or otherwise. The defects, which are not repairable in coach sites shall be recorded.

4.3 Digital photographs of defects will also be taken & recorded.

4.4 Categorize the defects as per Para 5 below:

### 5. TYPE OF DEFECTS

5.1 Type I - Pin Holes/Blow Holes, Small gel coat cracks on surface, pitting, blistering, de-lamination etc.

5.2 Type II - Crack in FRP panels through out the thickness, through damage of panels.

5.3 Type III - Industrial lock comes out because of damaged holes in FRP provided for fitment of industrial lock. Hole becomes oversize due to breakage of edges of holes.

5.4 Type IV - Paint flaking/Peel off, air bubbles on painted surface, dirty painted panels.

5.5 Type V - Major defects, which can not be repaired without moulds of concerned products.

### 6. PROCEDURE FOR REPAIRING

#### 6.1 Type I Defects

6.1.1 Surface Preparation: Small Pin Holes/ Blow Holes, Cracks, Blisters, pitting areas to be rubbed with water proof emery paper (Grit Size 220) at defect location for making the surface sticky for resin & removal paint from the damaged portion.

6.1.2 Mix Catalyst (MEKP) and COBALT by 1.5% & 1.0% by volume mix with resin.

6.1.3 Take small quantity of resin mix and apply at damaged portion with knife (putty work). Allow to cure for 20 minutes.

6.1.4 Finish the putty filled areas by rubbing with water proof emery paper (Grit Size 300 & 400).

6.1.5 Clean and Wash with Soapy Water & then dry by rubbing with soft cloth.

6.1.6 Masking of adjoining areas in the coach before painting. Paint/Touch up the repaired surface with PU paint of required RAL shade by colour matching at site as per RCF Spec. MDTs 118 Rev Nil, enclosed as **Annexure II**.

#### 6.2 Type II & Type III Defects

6.2.1 Mark the damaged portion.

6.2.2 Check the feasibility for repairing on site or by removal of the panels for repair outside the coach.

6.2.3 Remove the damaged portion of the panel by cutting with the help of angle grinder or drilling.

6.2.4 Grind the surrounding areas on unfinished side up to approximately eight centimeters from cut edge keeping slope towards the defect, so that 1 mm thickness remain at the end of edges of defects. This grinding helps to rework more area to add strength to the damaged panel.

6.2.5 Paste plywood sheet to damaged area for molding. If damaged portion is having some profile, then a flexible acrylic sheet or any alternate flexible material should be used, which can take profile of panel.

6.2.6 Hold the plywood panel or acrylic sheet with FRP panel with the help of adhesive tape or clamping.

- 6.2.7 Cut layers of Surface Mat, Chopped Strand Mat & Woven Roving as per the shape of damaged portion.
- 6.2.8 Apply Waxopol polish on plywood/acrylic sheet from unfinished side to release plywood after rework. Apply PVA afterwards with help of sponge. Allow it to dry for 15 Minutes approximately.
- 6.2.9 Apply Gel Coat Resin with a thickness of approximately 0.5 to 1mm. Allow Coating to cure for 30 minutes (Approximately).
- 6.2.10 Mix Catalyst (MEKP) and COBALT by 1.5% & 1.0% by volume mix with resin & apply with brush.
- 6.2.11 Apply Surface Mat (30gm/m<sup>2</sup>) with pre mix resin.
- 6.2.12 Apply Chopped Strand Mat (450gm/m<sup>2</sup>) & Woven Roving (600gm/m<sup>2</sup> & Chopped Strand Mat (450 gm/m<sup>2</sup>) with premix resin in the sequence. Ensure the reinforcement proper with the help of roller or other tools.
- 6.2.13 Make reinforcement as per thickness of panels.
- 6.2.14 Allow moulded part to cure for one hour.
- 6.2.15 After complete curing removal ply wood/acrylic sheet from the molded components.
- 6.2.16 Rubbing with water proof emery paper (Grit Size 220) on finished side for surface preparation.
- 6.2.17 Re-drill the hole (In case of Industrial Lock place repair) after proper curing).
- 6.2.18 Clean and Wash with Soapy Water & then dry by rubbing with soft cloth.
- 6.2.19 Paint/Touch up, as per Clause 6.1.6.

### 6.3 Type IV Defects

- 6.3.1 Grinding of damaged paint portion with Water Proof Emery paper (Grit size 220).
- 6.3.1 Re-fill of pin-holes by method as described for Type I defects, if any, noticed during grinding.
- 6.3.2 Clean and Wash with Soapy Water & then dry by rubbing with soft cloth.
- 6.3.3 Paint/Touch up, as per Clause 6.1.6.

### 6.4 Type V Defects

- 6.4.1 Take out the damaged panel from the coach. Procure replacement panel from the vendors and replace it with new one
- 6.4.2 If it is possible moulds of the same to be arranged by the firm. Hand over the damaged panel to vendor for repair who will repair it with the help of mould.
- 6.4.3 Repairing of damaged portion by Type II & Type III defects methods.
- 6.4.4 Alternatively small template/mould for the damaged portion may be developed, in case of frequency of defect at the same location is more. Repair should be tried in coach itself.
- 6.4.5 Paint/Touch up, as per Clause 6.1.6.

## 7. REQUIREMENTS

The following have to be arranged by repairing personnel:

- Highly skilled manpower with sufficient Expertise should be arranged by for repairing. A list of such staff to be submitted to sick line in charge.
- Tools required for repairing are as per **Annexure III**. Power connection & compressed air etc. will be required for repairing.
- Materials (as per specification) for repairing shall be estimated, after examining the amount of repair work. List of such material is enclosed as **Annexure IV**. This gives the details of raw material with specification, approximately price and likely source of supply.
- The make/vendor of FRP components is marked at the back side of the panel/hidden side.