FIBERGLASS SLIDE MAInTEnAnCE & REpAIR MAnUAL

waterplay

ContAct InformAtion

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1.0 Fiberglass Slide Maintenance and Repair Overview

This Fiberglass Reinforced Plastic (FRP) Maintenance and Repair manual is provided to help water park operators manage their Waterplay Water Slide in accordance with the requirements of ASTM F1193 standards and to describe recommended best practices for maintenance tasks.

Waterplay provides operators with this comprehensive maintenance and repair information so they can keep their Water Slide in top operating condition and looking great.

This section provides maintenance and repair procedures that may need to be performed from time to time.

It also provides an overview of FRP surface quality and types of damage that may happen, and the operating conditions that their Water Slide is subject to.

The operating procedures present in this manual are presented to Water Slide owners as guidelines only. They are not intended to be mandatory or exhaustive. These guidelines do not replace the following:

- Proper consultation with designers, manufacturers, and legal counsel
- Compliance with local, state (provincial) and federal regulations and laws involving, but not limited to: health, safety, and building codes

2.0 FRP Surface Quality

The main factors that affect FRP Surface Quality are:

- Environmental conditions
- Mineral deposits and surface degradation from water
- Ultraviolet (UV) light radiation
- Friction wear

Regular and specific maintenance of the flume, framework, and thematic surfaces will keep the Water Slide in safe operating and optimal riding and looking condition for years.

Maintenance procedures are covered in FRP Maintenance.

2.1 Environmental Conditions

At water parks in different regions of the world, FRP surfaces are exposed to a wide variety of environmental conditions.

- Air Quality – humidity, aridity, salinity
- Temperature – extreme hot and cold ranges can cause expansion and contraction at different rates
- Water quality – pollution, TDS, mineral, microbial, cleaning, hygiene, chemical content

The performance of cleaning products can be affected by these different environmental conditions.

2.2 Mineral Deposits

This section covers the following:

- Overview
- Chemistry
- Process

2.2.1 Overview

Water readily dissolves various minerals from the ground, soil, and creek beds that it flows through and carries the minerals as Total Dissolved Solids (TDS). Different regions and communities have different mineral contents in their soil and therefore in their water.

Common minerals and compounds found in water include the following:

- Calcium Carbonate
- Calcium Sulfate
- Iron
- Magnesium Carbonate
- Magnesium Hydroxide
- Magnesium Oxide
- Magnesium Sulfate
- Manganese
- Potassium Chloride
- Sodium Chloride

When water evaporates from a wet surface, the residue left behind contains these mineral compounds. These deposits appear on surfaces as white scale and are sometimes called “water spots”. These deposits can cause unsafe rider conditions.

The chemical nature of these crystalline minerals enables them to bond to surfaces aggressively and they need more than water or mild soap to remove them.

Figure 1: Mineral Deposits on FRP

2.2.2 Chemistry

Mineral deposits are salts. To chemically remove these salts, they need to be dissolved using an acid mixture, causing a chemical reaction. Due to the varying composition of these deposits, generally no single acid will handle all of the salt and mineral possibilities. A combination of acids with different characteristics is needed.

2.2.3 Process

As with most chemical reactions, there are three key elements of this reaction chemistry:

- Acid concentration - is controlled by safety issues. The concentrations have to be formulated to be used on site by the average worker with basic personal protective equipment and safety training.
- Temperature - higher temperatures can speed chemical reactions and lower temperatures slow down reaction times.
- Time - time is the main controllable variable in site operations. The longer the acid solution can interact with the mineral deposits, the more salts will be dissolved. We need to keep the surface wet with the solution, without the water content evaporating. Once the water is dissolved from the acid solution, it is no longer an acid and the reaction will stop.

For sites where heat and direct sun exposure dry the water quickly, the acid solution can be applied in a gelatin mixture, to keep the water in a liquid state longer.

To prevent the salts from re-depositing on the slide, sequestrant chemical compounds in the acid mixture attach themselves to the dissolved minerals so they are removed when the compound is removed from the surface.

2.3 UV Radiation

UV radiation degrades FRP exposed to sunlight. Over time, the plastics lose their colour, strength, and can eventually crack and deteriorate, requiring replacement.

Exposure time and light intensity increase the degradation of exposed surfaces.

Waterplay uses UV inhibiting pigments in their surface colouring processes to slow the effects of UV, but reapplying absorbers (and eventually gelcoat) is needed over time to keep the surface colours bright and shiny.

On surfaces which originally had a UV absorbent clear coat applied for protection, any refinishing will also require a new clear coat finish to slow the radiation's effect.

Figure 2: UV Radiation Effects on FRP

2.4 Friction Wear

Riders also wear down the surfaces of slides and structures. Ideally, water is between the slide surfaces and the riders. However, sometimes they come in direct contact due to rider movement.

Airborne dust and metal objects on clothes can also get between riders and the surface. These kinds of scratches require more serious repairs to the surfaces, including sanding, filling, and applying gelcoat or gelcoat putty.

2.5 Stickers

Figure 3: Friction Wear on FRP

Remove stickers with soap and warp water and a soft putty scraper.

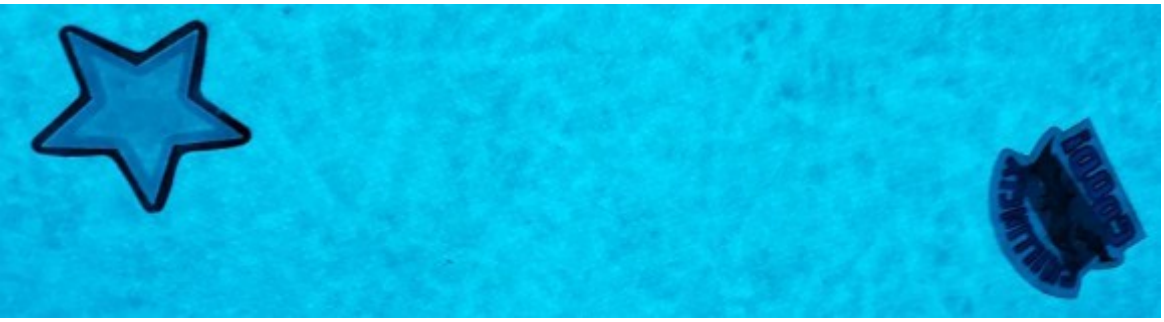


Figure 4: Stickers and Adhesive Glue on FRP

3.0 FRP Maintenance

This section covers maintenance and procedures used to keep water park FRP components in top operating and looking condition.

Waterplay and many other companies provide products to clean FRP, remove mineral deposits, and buff and wax the slide surfaces for optimal performance and rider experience.

At water park Water Slides in different regions of the world, FRP surfaces are exposed to a wide variety of environmental conditions. The performance of cleaning products can be affected by these different environmental conditions.

3.1 Waterplay Maintenance Products

Waterplay offers SlideRenu maintenance products, exclusively available to Waterplay customers.

3.1.1 Calcitrol™ Scale Remover

- Low-PH concentrated ready-to-use formula removes calcium and hard water mineral deposits (“White Haze”)
- Environmentally and worker safe organic salt formula that chemically reacts to dissolve away white haze build-up

3.1.2 SlideDetergent™ Heavy Duty Degreaser

- High-PH water-based technology that removes tough surface contaminants such as leaf stains, scum lines, bird droppings, acid rain, and other unwanted surface residues
- Biodegradable, no VOC's, petroleum solvents or paint damaging cleaning acids such as bleach or muriatic acid

3.1.3 SlideSoap™ Mild Daily Cleaner

- Low suds-foaming cleaner that gives water the properties to loosen surface contaminants on play structures and decks
- Biodegradable, worker safe, no VOC's, PH neutral and can be used frequently without harming any surfaces

3.1.4 SlideWax™ Surface Protectant

- Unique synthetic polymer wax that seals and protects metal, fiberglass, and PVC surfaces from chlorinated pool water
- High melting point formula outlasts carnauba, car, and marine waxes which turn cloudy from intense UV rays

3.1.5 SlideCompound™ Oxidation Remover

- Micro-abrasive cutting system removes embedded oxidation, the first step prior to waxing all surface types
- Water soluble formula contains no wax, silicone, or solvents leaving very little reside

3.2 Other Maintenance Products

FRP can be cleaned and maintained with other products as well.

- 3M Multi-purpose Boat Soap
- 3M Marine 1 Step Fiberglass Restorer and Wax
- Acetone
- Automotive cut polish
- CLR mineral remover
- FR100 or FR300 buffing compound
- Sikaflex 1a polyurethane adhesive joint filler
- Turtle Wax

3.3 Maintenance Procedures

If properly maintained, your Water Slide will give you years of service and keep sliding the way it was meant to: SAFE and FUN.

By keeping the slide and its components properly maintained, you will be ensuring high performance and long life.

The following maintenance procedures are covered:

- Cleaning
- Buffing and Waxing
- Refilling Joints between FRP Sections

3.3.1 Cleaning

Maintenance requires removal of surface dirt, grease, and suntan oil by cleaning the slide paths. For regular cleaning, use a soft-bristled brush and mild detergent or automotive and marine soaps to keep skin lotions and other regular accumulations off the FRP.

To remove water spots and mineral deposits (a white chalky discolouration), use cut polishes, rubbing compounds, finish waxes, or any combination of products. Always test the product first in an area out of sight.

To remove hard water buildup (a white chalky discolouration), using a calcium, lime, and rust remover:

1. Apply a full wet coat of calcium, lime, and rust remover or other solution to the contaminated surface.
2. Scrub the surface with a plastic scrubber if needed.

Figure 5: Scrubbing Calcium, Lime, and Rust Remover on FRP

3. Ensure that the surface remains wet for the required time stated on the product label.
4. Rinse the surface to remove the solution along with dissolved minerals.

Wear gloves and mask if the product requires it. Test the cleaner on out of sight locations for discolouration. To remove difficult stains, use cut polishes, rubbing compounds, and finish waxes or any combination of such products.

It is recommended that any area worked with abrasive pads, chemical pads, or alternate chemicals must be properly rinsed to remove any residual chemical, buffed to a polish with a buffing compound and coated with a sealing compound to revitalize the shine and protect the surface from reattachment of water deposits.

3.3.2 Buffing and Waxing

At least once every two months of operation, the fiberglass finish must be buffed and waxed with high quality paste waxes or polishes.

1. On scratched, dull, or faded areas use a fine buffing compound to restore the original gloss before waxing.
2. Apply the compound with a rag, then buff to a shine. The more often the surface is waxed, the longer it will last and the better the slide will perform. Waterplay recommends buffing and waxing the Water Slide surface every 2-3 months.

Figure 6: Buffing and Waxing Shutdown Lane FRP

Prolonged exposure to the ultra-violet (UV) rays of the sun over time can cause discolouring and fading. Waterplay recommends using paste waxes or polishes that provide UV protection.

Washed and waxed surfaces are critical to proper and safe operation. Calcium buildup, for example, may cause riders to stick, which may lead to unpredictable behavior and unsafe conditions.

When using power tools for buffing or polishing, use extreme care to prevent overheating the surface. Overheating a rubbing compound burns small gritty particles into the slide surface, causing blistering and streaking. This may require the area to be sanded and refinished.

⚠CAUTION

3.4 Refilling Joints Between FRP Sections

Joints between slide sections play an important role in rider comfort and pleasure. Proper maintenance will keep the joints smooth and trouble free for years.

Fiberglass sections expand and contract with temperature changes. Use a flexible polyurethane adhesive sealant to fill joints between sections.

Where it is available, Waterplay recommends flexible polyurethane sealant such as Sikaflex 1a by Sika for joint filling at installation or 5200 by 3M for maintenance and replacement. Sikaflex cures in seven (7) days, while 5200 cures in 24 hours.

DO NOT use plastic filler that will harden.

DO NOT pour lacquer thinner directly onto a flume joint as it can dissolve the sealant. Use cleanup solvents as per manufacturer's instructions.

DO NOT put fiberglass over the joints. Glassed-over joints that crack may leave jagged edges that can injure a rider.

⚠CAUTION

To replace joint filler:

1. Remove all the old filler from the joint using hand or power tools as required.

Figure 7: Removing Old Filler

Figure 8: Mechanically Remove Filler and Deburr Edges

2. Deburr the joint edges so they are smooth with no sharp edges or plastic protruding from the level surfaces.

3. Vacuum the joints and then clean the inner faces of the joint with acetone.

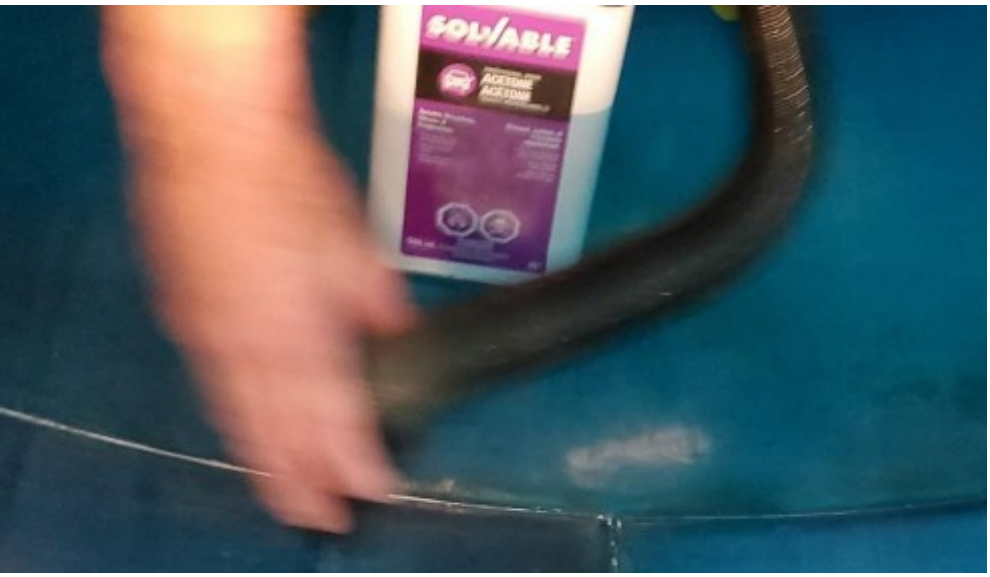


Figure 9: Vacuum and Clean Joints with Acetone

4. Use a flexible polyurethane adhesive sealant to refill the joints with a caulking gun with the nozzle hole matching the joint size.

NOTE

Warm up the adhesive filler tube before starting to apply, for easier flow.

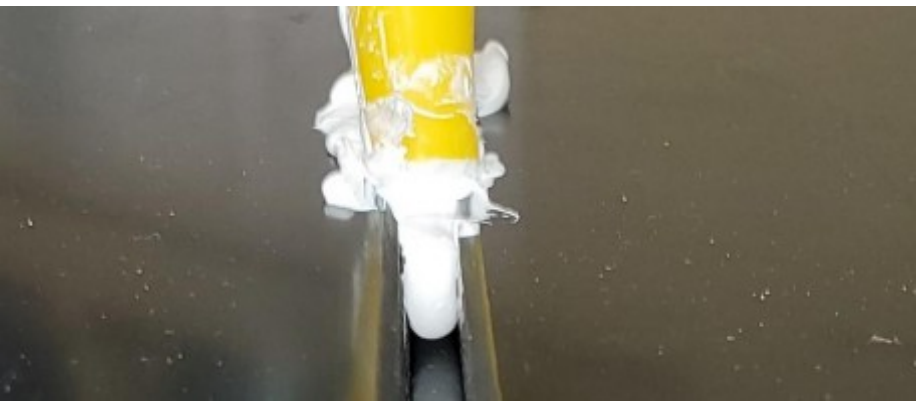


Figure 10: Refill Cleaned Joints

5. Ensure the joint fills from bottom to top with no air pockets covered over by the sealant.

6. For deep and narrow joints, pack the filler in with a putty knife if needed.

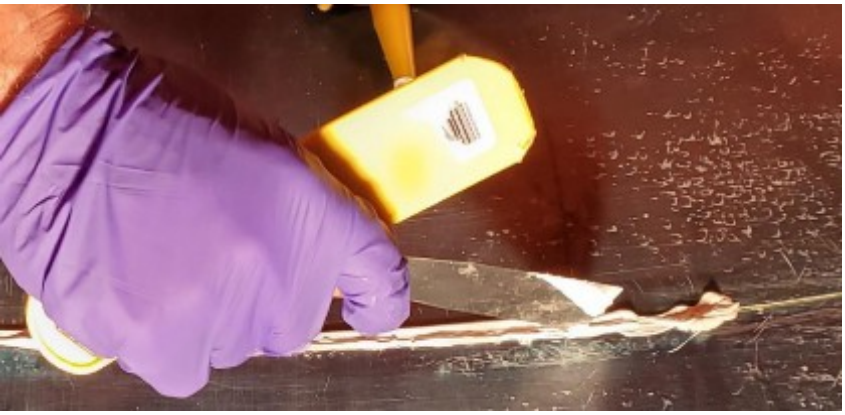


Figure 11: Pack in Joint Filler

7. Remove excess joint filler from the slide surface by scraping it off with a putty knife.

Figure 12: Press in New Filler

8. Wipe off remaining filler with a rag and acetone or the manufacturer's recommended solvent.

9. Wiper in the direction of the joint, not across it, to avoid pulling filler from the joint.

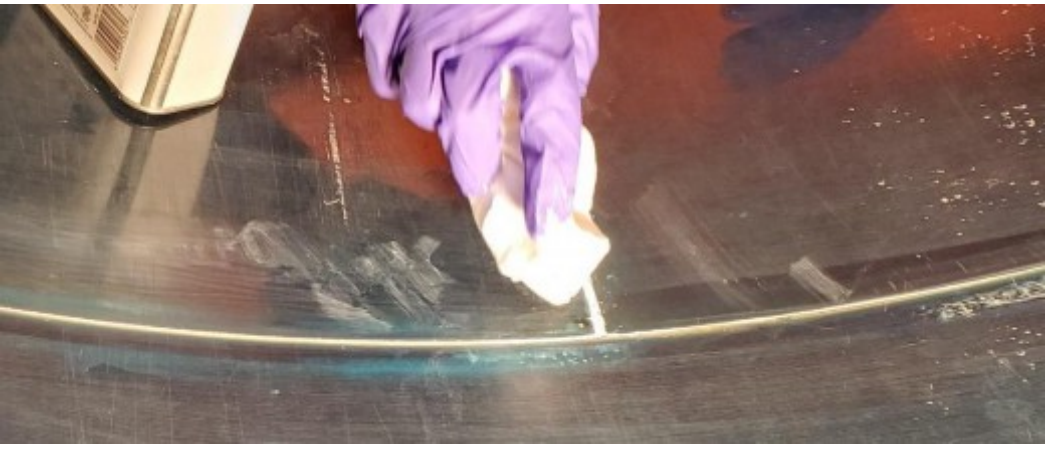


Figure 13: Wipe Off Remaining Filler

4.0 FRP Damage Types and Repair Summaries

This section provides detailed examples or major and minor damage to FRP water features. Before repairing a fiberglass part, investigate the defect or damage to determine the proper repair method.

Repair procedures are covered in FRP Repairs.

4.1 Major FRP Damage

Fiberglass damage is structural and requires removing damaged material, placing fiberglass, sanding, reapplying gelcoat, and finally buffing.

4.1.1 Cracks

Cracks are signs of structural damage that requires immediate attention. Fiberglass must be applied on both sides of the part. If the damage is too severe, the part may need to be replaced.

Figure 14: Crack in FRP

4.1.2 Punctures and Holes

Punctures can be defined as any place where a hole has been made in the slide surface from an impact with a hard object. This type of defect must be repaired immediately in order to maintain the integrity of the slide.

Figure 15: Puncture Holes in FRP

4.1.3 Large Fractures

Large fractures in the fiberglass are less common than other defects but are very serious. If the FRP has been fractured, a great amount of force must have been applied to cause it.
Fiberglass does not tear easily.

Fiberglass fractures are usually found on the outer edges of the part, typically on the bolting flanges. The flanges are critical to the structural integrity of the part.

Any fractures to the slide component could seriously degrade the structural integrity of the slide section and must be fixed immediately.

Figure 16: Fractured FRP

4.1.4 FRP Deformation

FRP deformation such as buckling can slow riders down and cause blocking in the slide. They can be caused by improper installation or pressure from outside the flume path. The deformed area must be repaired, or the part must be replaced.

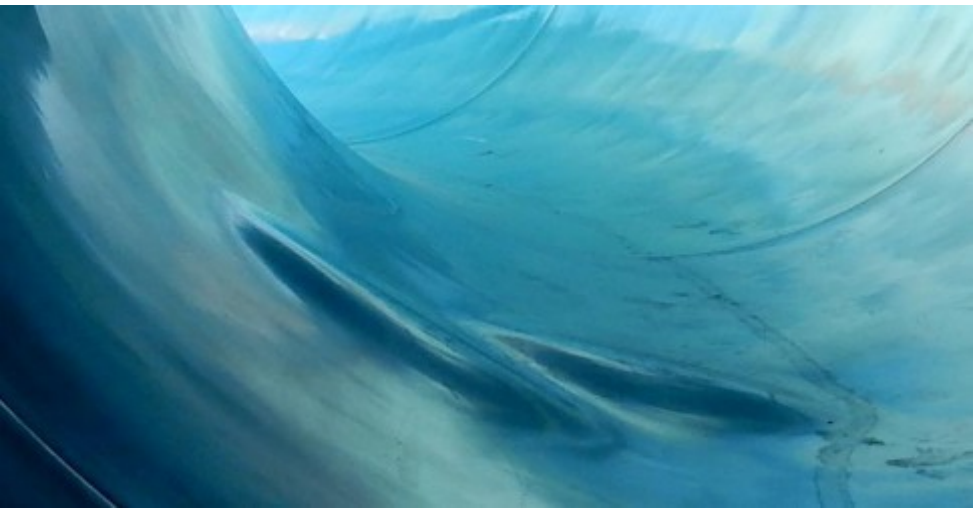


Figure 17: FRP Deformation, Slide Path Obstruction

4.2 Minor FRP Damage

4.2.1 Dents and Scrapes

Dents and scrapes are greater than 2.5 cm square or deeper than 2 mm.

Here is an example of a large dent that will need to be repaired with fiberglass.

Figure 18: Dent in FRP

4.3 Gelcoat Damage

4.3.1 Gouges

A gouge is damage that goes through the gelcoat. Fill gouges that go through the gelcoat with colour-matched gelcoat putty.

Figure 19: Gouge in AquaLucent FRP

4.3.2 Small Chips

Fill chips that go through the gelcoat with gelcoat putty

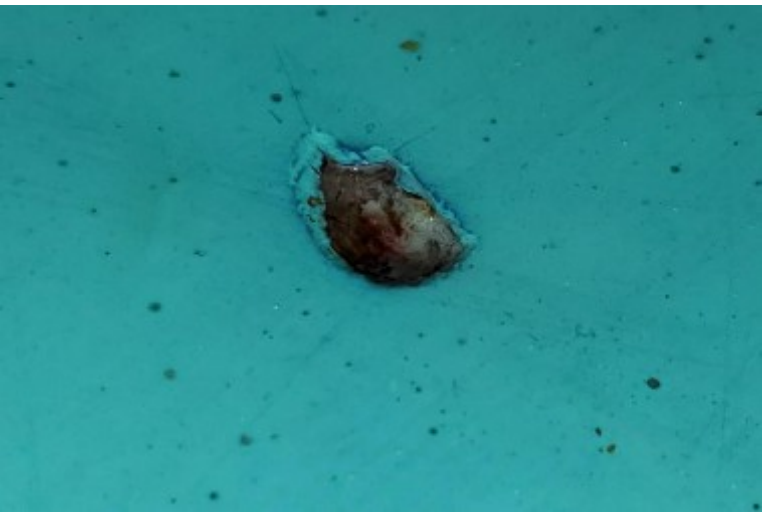


Figure 20: Small Chips in FRP

4.3.3 Small Gelcoat Cracks

Small cracks are typically caused while bolting slide sections with impact guns, or from an impact to the slide surface from a hard object. These defects can be difficult to detect and will adversely affect slide performance if they are not fixed. Impact fractures are usually visible at the gelcoat surface and appear as a concentration of small cracks spreading outward from a central point.

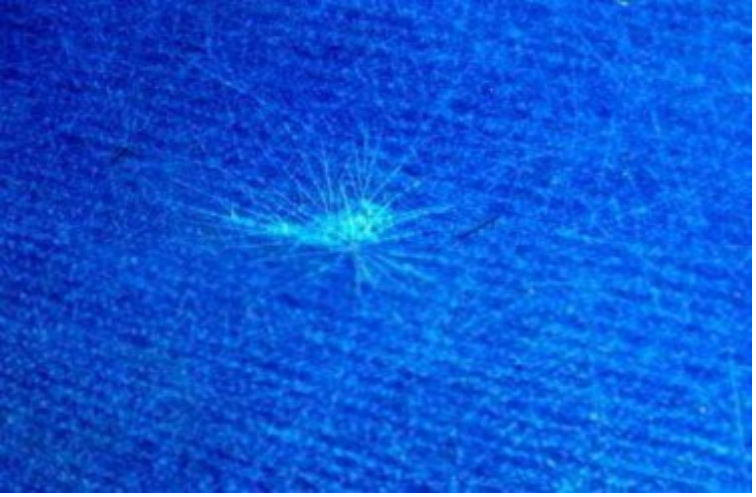


Figure 21: Small Cracks in FRP

4.3.4 Scratches

Scratches are damage to the gelcoat. Fill deep scratches with gelcoat or gelcoat putty. Sand and buff light scratches. If scratches occur on the back side of a part that was originally finished with clear coat, Waterplay recommends finishing the repair with clear coat again, to maintain surface consistency.

Figure 22: Scratches in Gelcoat

4.3.5 Peeling or Faded Clear Coat or Gelcoat

Peeling or faded clear coat or gelcoat can happen over long periods of time with heavy usage and exposure to elements and chemicals in the water.

These surfaces need to be sanded down and refinished with clear coat or gelcoat.

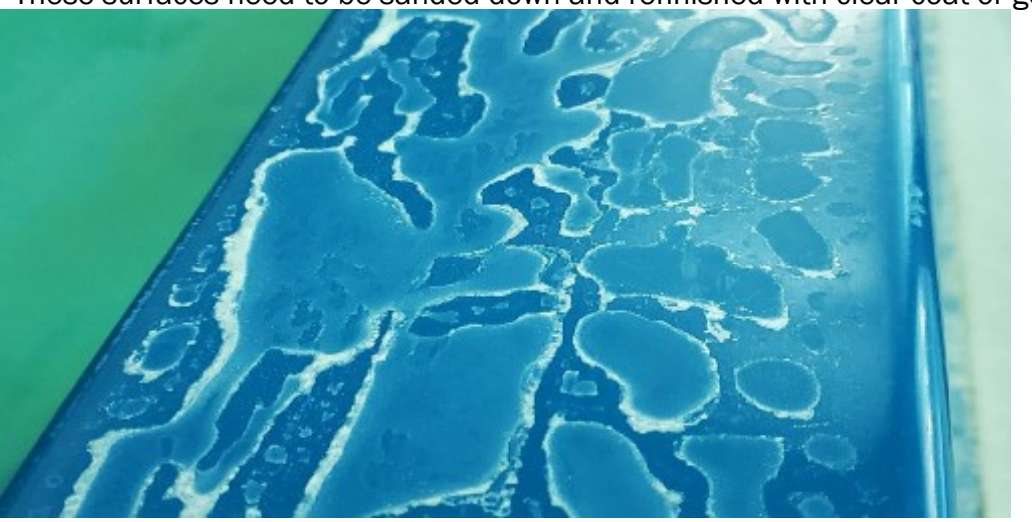


Figure 23: Peeling Clear Coat

Figure 24: Faded Clear Coat DC92

5.0 FRP Repairs

Minor FRP repairs can be done by the operator's maintenance team, but Waterplay recommends that a qualified fiberglass professional perform major structural FRP repairs.

Occasionally, repairs to the Water Slide FRP need to be done. This manual covers the following common repair considerations.

- Repair Types
- Safety Precautions
- Environmental Considerations
- Repair Equipment
- Site Preparation

5.1 Repair Types

This guide provides fiberglass, gelcoat putty, gelcoat, clear coat and barrier coat repair methods for damage to AquaLucent and Translucent FRP parts.

- Fiberglass Repair – will also require gelcoat putty repair, and may require gelcoat repairs, and clear coat finishing.
- Barrier Coat Repair – will also require gelcoat repairs and clear coat finishing.
- Gelcoat Putty Repair – may also require gelcoat repairs and clear coat finishing.
- Gelcoat Repair – may also require clear coat finishing.
- Buffing and Sealing – required for finishing the slide surface repairs.
- Clear Coat Finishing – required for finishing repairs to the backside of the flume, not on slide surface.

5.1.1 Translucent Repairs

Translucent repair considerations are included in the following procedures.

Translucent FRP repairs are similar to AquaLucent gelcoat-coloured FRP repairs but require attention with clear resin and tinting and curing rates to match the existing semi-transparent finish.

Figure 25: Translucent Inside Damage and Buffed Inside Repair, Before and After

5.2 Repair Precautions

Before starting any repair, determine what safety precautions, temperature constraints, and repair equipment you need to consider.

Making repairs to fiberglass can be hazardous. If working at heights or on steep sections, ensure safe and secure access is available.

Always wear personal protective equipment (PPE) such as safety glasses, rubber gloves and an organic vapor respirator if working in a confined space. When grinding fiberglass, use a respirator or a dust mask.

The chemicals used in fiberglass repair are hazardous and all safety data sheets (SDS) and product labels must be read and understood before making any fiberglass repairs.

5.3 Environmental Considerations

Environmental conditions at the repair site can affect the gelcoat and fiberglass application, setting time, and cure quality. The resin and gelcoat and the slide surface must be between 15°C – 32°C (60°F – 90°F), with ideal temperatures between 21°C – 27°C (70°F – 80°F). It is not advisable to attempt fiberglass repairs in damp or wet conditions. Water is incompatible with resin and can adversely affect resin cure and structural properties.

If applied below optimal temperature or in high humidity, the resin and gelcoat will not cure to a solid state for sanding, buffing, or gelcoating. If applied above optimal temperature, it will set too quickly and can bubble up and even combust if it cures too fast and the layers are too thick.

If the conditions are not right, the repair area will have to be isolated from the outside environment with tarps and heated or cooled as needed, or the part will have to be moved to a climate-controlled area for repair.

⚠CAUTION

5.4 Vertical Surface Repairs

Repairs to vertical surfaces must be done by specialists with plenty of experience laying fiberglass and coating fiberglass surfaces.

Applied heat (lamps, guns) and a higher percentage of catalyst in vertical repairs helps the fiberglass cloth, resin, or gelcoat putty set in place with minimal running and drips. That means smaller batches will need to be applied with shorter time to work with the material, and more trimming and sanding steps between cured batches.

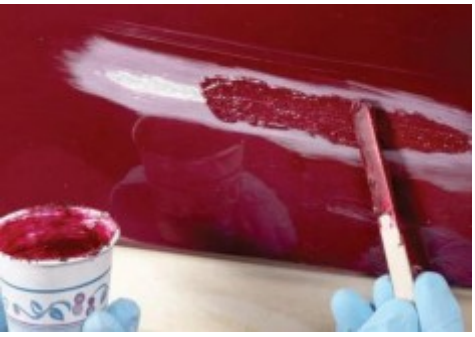


Figure 26: Vertical Surface Repairs

5.5 Materials and Equipment for Repairs

⚠WARNING

Wear appropriate hand, eye, ear, respiratory, and skin covering PPE.

Patching kits contain toxic, combustible, and corrosive elements. Use only under well ventilated conditions.

Do not inhale fumes. Seek medical attention if polyester resins are swallowed or inhaled.

Should contact occur with the eye, flush with water for 15 minutes and seek medical attention. If the person is wearing contact lenses and the lenses did not flush out from the water, have the person try to remove AFTER the flushing procedure. If contents contact skin or clothing, clean area immediately with acetone.

5.6 Repair Preparations

Before doing any grinding or filling, the damaged area needs to be marked, taped off, sanded, and cleaned.

Figure 27: Marked Area for Repairs

1. Clean the repair area with a clean cloth and acetone to remove any dirt of contamination.
2. Mark off the repair area with a marking pen.

5.7 FRP Joint Repair

Joints between FRP parts may become rough with use and after they have been cleaned out for refilling, especially if metal objects have come into contact with the surface of the slide.

For minor chips and cracks, the joints may be fixed using the procedures for Gelcoat Putty Repair.

More serious cases may require power sanding that will cut through the gelcoat or even fiberglass repair. This will require a fiberglass repair, putty fill, sanding, and spray application of new gelcoat by a trained person and finished by sanding and polishing and waxing as outlined in the procedures for Buffing and Sealing.

5.8 Fiberglass Damage Preparation

The damaged part will need repair on both sides of the damaged area. It is critical that the repair to the inside slide surface matches the existing slide surface.

If the repairs are too large to finish with just putty over the fiberglass, then a gelcoat refinish will need to be done on both sides of the repair area.

FRP puncture repairs are generally done from the outside in, as the damage most often also happens that way.

FRP dust is harmful to eyes and lungs. Grinders are loud. Wear goggles and masks and earplugs when grinding and sanding FRP.

1. From the outside, use a 60-grit grinding disc to grind away a 2 to 4” taper (or 15 to 20° angle) from the inside edge of the damaged area.

Figure 28: Grind Away Repair Area

2. Remove as little as possible from the inside surface edge.

3. Make the opening as smooth as possible, so that after the hole is filled, the least amount of filling and fairing is needed to finish the inside surface.

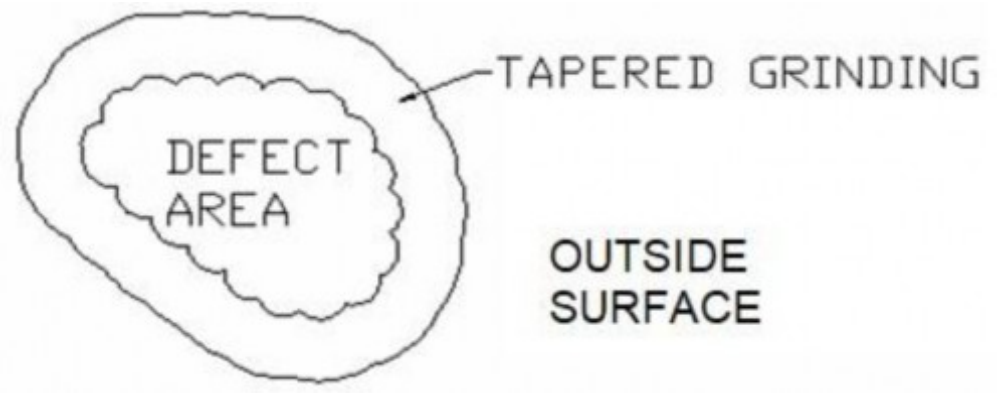
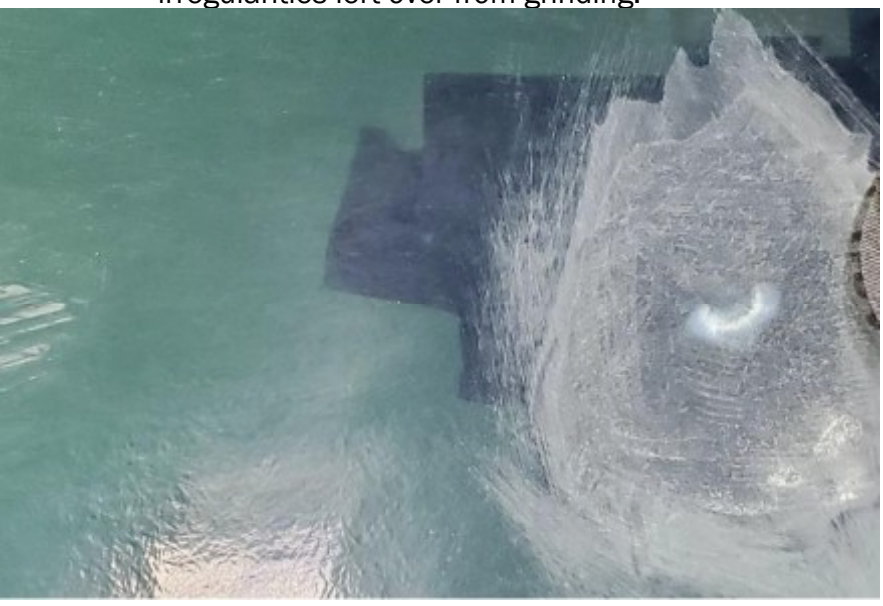


Figure 29: Grind Away Repair Area, Side View

4. Once the hole has been ground down, sand the ground area with 100 grit sandpaper to remove any irregularities left over from grinding.



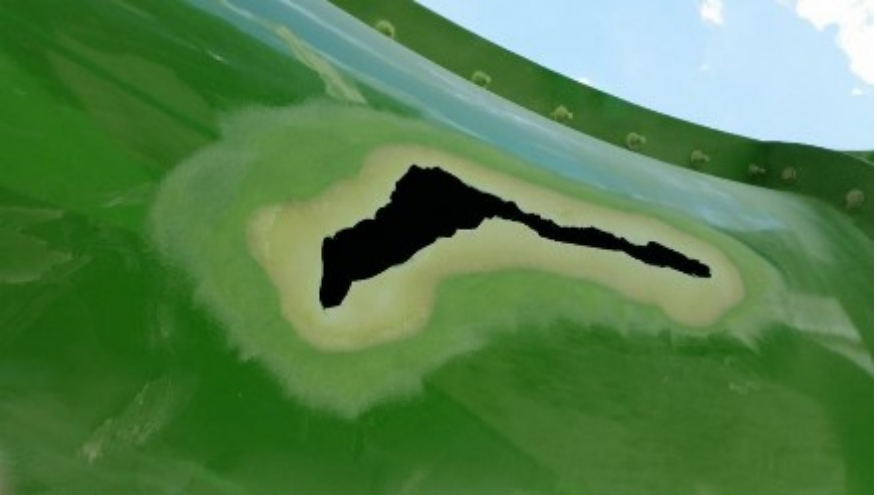


Figure 30: Grind and Sand Edges of Repair Area

5. Vacuum or brush away fiberglass dust from the inside and clean the outside sanded area with acetone to remove any dirt or contamination.

6. Clean the area on both sides with acetone.

7. If the hole is small enough, cover the inside of the hole with several layers of masking tape.

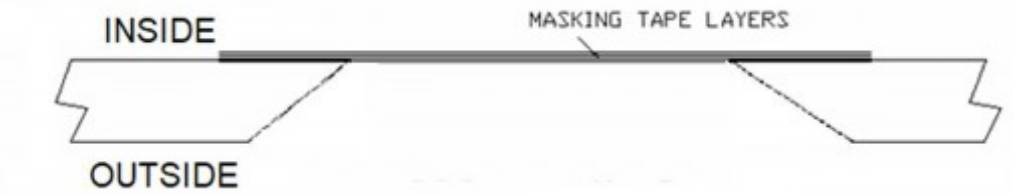


Figure 31: Mask Inside of Holes

8. Ensure the tape is sticking well to the surface around the damaged area.

9. Larger holes may need to be covered with a semi-stiff sheet of plastic, covered in masking tape to match the inner curve of the part and to protect from adhesion during the repair.

10. If needed, apply light weights or padded braces to hold the inside hole cover.

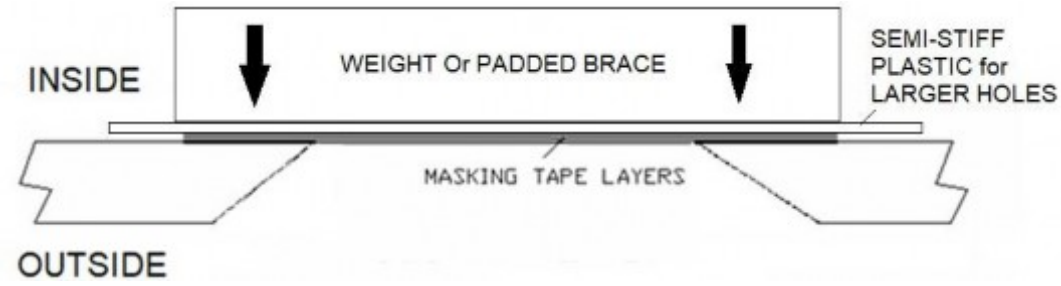


Figure 32: Support Larger Masked Holes

NOTE

Contour plastic or tape to match the natural curve of the slide path surface.

11. To fill the puncture with new fiberglass, use the procedure for Fiberglass Repair.

5.9 Fiberglass Repair

In order to produce a good cosmetic and structural repair, proper fiberglass laminating technique is very important. Key factors that influence good fiberglass repairs include.

- Fiberglass to resin ratio
- Fiber wet out/compaction
- Air removal
- Resin mix/cure

Follow these steps closely to ensure that all fiberglass repairs are of high quality and high strength.

NOTE

Fiberglass repair is time sensitive. Make sure that all materials and tools are present and ready for use when the lamination procedure is started.

All preparation must be completed on the repair spot, and tools and materials must be ready for use. Pre-cut fiberglass shapes to fit the repair spot.

5.9.1 Fiberglass Ply Types

The main types of fiberglass ply material used for FRP repairs are chopped strand matt (CSM) and woven roving layered (WRL) cloth.

- CSM has randomly-oriented fibers and is good for localized repairs on odd- shaped areas, holes, and deep chips.
- WRL is a tighter and heavier fiberglass cloth and is used for manufacturing parts or structural repairs on flanges and body transitions.

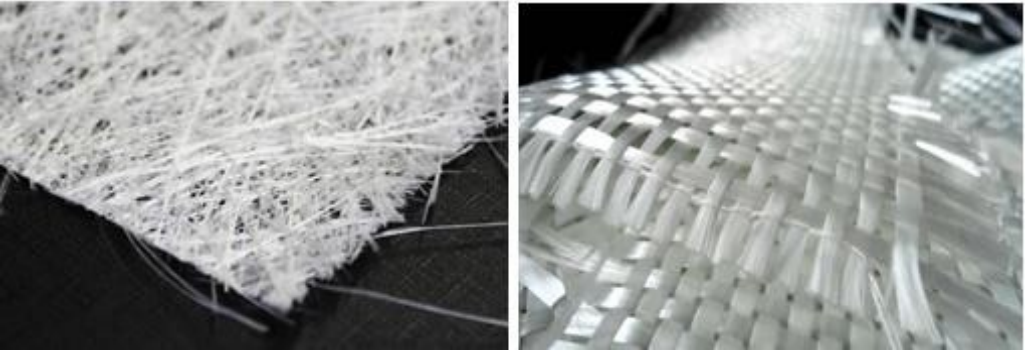


Figure 33: Chopped Strand Mat and Woven Roving

5.9.2 Resin Mixing

Although most fiberglass systems are reasonably forgiving, it is important to get a proper resin to catalyst ratio to achieve a proper cure and give enough working time before the material starts to cure.

Optimal operating and curing temperatures are between 15° and 30° C (60° and 85° F). Some conditions may require a hotter cure temperature.

1. Visually estimate how much resin will be needed for the repair and pour the amount into a measuring cup that will not melt when the resin is mixed with the catalyst. Round up to an even measurement to make the catalyst percentage calculation easier.

   Experience is the best guide for determining the amount of resin to use, but it is a good rule to start out with a little excess resin and reduce the quantities mixed as you gain experience.

2. To determine the amount of catalyst, use the chart below as a starting point and when you have decided on a percentage, multiply the volume of resin by the percentage amount to determine the catalyst volume.

Temperature °C (°F)	Catalyst % by Volume	Ideal Cure Time
15 – 21 (60 – 70)	2.5%	20 min touch, 2+ hrs. to sand
21 – 27 (70 – 80)	2%	20 min touch, 2+ hrs. to sand
27 – 30 (80 – 85)	1.5%	20 min touch, 2+ hrs. to sand

   For example, if you have 50ml of resin in a cup, and have chosen to use 2% catalyst, then you will need 1 ml of catalyst.

   (50ml X 0.02 = 1ml).

3. Use the graduated dropper provided in the kit to measure the proper amount of catalyst.

4. Add the catalyst to the resin and mix it thoroughly with a metal or plastic mixing stick.

   NOTE

   Do not use wood as a mixing stick as wood can absorb catalyst and lower the catalyst ratio.

5. Keep track of the time when adding catalyst to the resin to ensure the repair can be completed before the resin cures.

5.9.3 Lamination

Laminating fiberglass is relatively simple, but care must be taken to make sure that a high- quality laminate is produced.

1. When pre-cutting fiberglass, be sure to cut the pieces so they fit flush in the bottom of the repair spot.

2. Cut slightly larger pieces of fiberglass for each layer in the tapered hole.

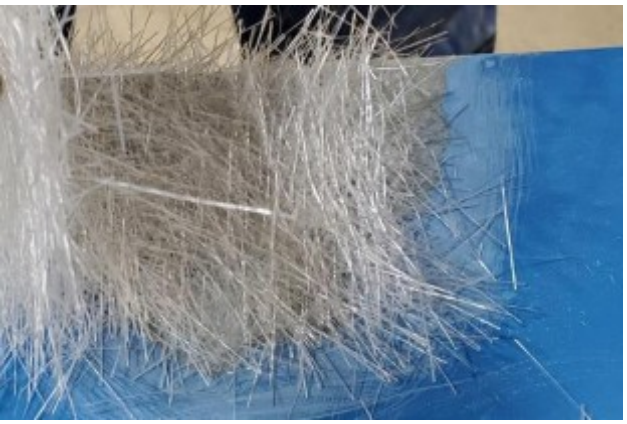


Figure 34: Prepare Fiberglass Pieces

3. Wet repair area with resin using a paint brush.

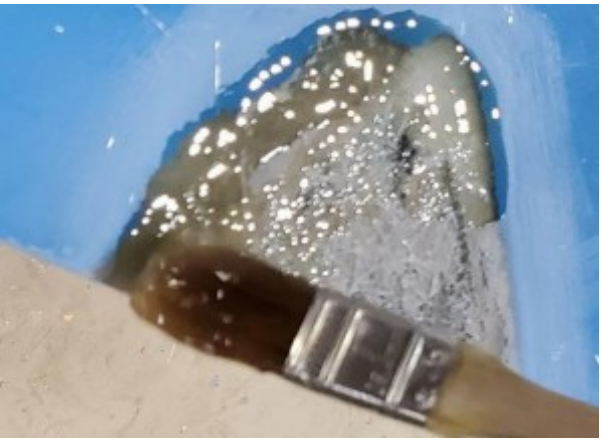


Figure 35: Wet Repair Area with Resin Mixture

The area must be completely covered in resin but must not be so wet that the resin pools in the corners.

If the resin is pooling, use the paint brush to soak up some of the excess.

4. Lay the first layer of fiberglass reinforcement into the repair and use the paint brush to push the resin through the mat until the glass is completely saturated by the resin.

Figure 36: Use Paint Brush to Soak Fiberglass with Resin

5. Be careful not to add so much resin that the resin pools, runs, or drips.

6. Use the tip of the paint brush to dab and push any air out from the edges.

7. If the repair spot is large enough, use a metal roller to compact the laminate and remove air.

Figure 37: Smooth Out Air Bubbles with Metal Roller

8. Continue adding layers of glass and wetting them out. Ensure that all air bubbles are out of each layer before adding another layer.

Figure 38: Soak Fiberglass with Paint Brush

9. Add layers of glass until the laminate is one layer over the original surface. This will provide some material to sand smooth and allow for shrinkage during cure.

Figure 39: Cured Fiberglass Repair, Outside

10. Clean tools with acetone.

11. Allow the repair to cure for at least two hours at room temperature before proceeding with finishing operations.

12. Sand the cured fiberglass repair with 40 to 100 grit sandpaper until it is level with the original surface profile level.

Figure 40: Sanding Fiberglass Repair

13. Remove dust and wipe the area down with acetone.

14. Watch for pin holes in the cured FRP. They can be filled with gelcoat or gelcoat putty.

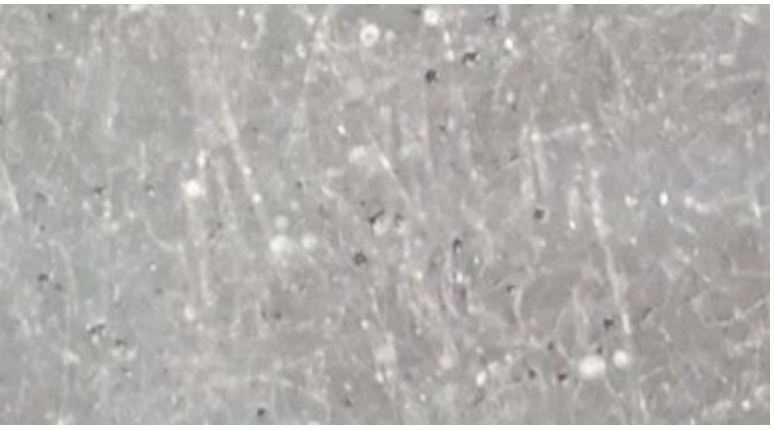


Figure 41: Pinholes in FRP Repair

15. To finish the fiberglass repair, continue with the following procedures:

- Gelcoat Putty Repair.
- Gelcoat repair.

5.10 Gelcoat Putty Repair

NOTE

Putty repair is time-sensitive. Make sure that all materials and tools are present and ready for use when the putty application procedure is started.

All preparation must be completed on the repair spot, and tools and materials must be ready for use.

Gelcoat putty repairs require colour-matched material to get the best finish results.

This type of fiberglass finishing repair is common for small defects and scratches and takes very little time.

Figure 42: Defect for Gelcoat Putty Repair

5.10.1 Mixing Gelcoat Putty

1. Distribute the desired amount of colour matched putty to a mixing board with a putty knife.

2. Estimate the volume that is on the mixing board and calculate the amount of catalyst required. The ratio must be 1.5 – 2.5% by volume.

3. For example, if you have 50ml of putty on a board, and have chosen to use 2% catalyst, then you will need 1 ml of catalyst. (50ml X 0.02 = 1ml).

4. Use a graduated dropper to measure and distribute the catalyst.

5. Mix the catalyst well with a putty knife.

5.10.2 Gelcoat Putty Application

1. Use a putty knife to spread putty into the defect.

Figure 43: Applying Gelcoat Putty

2. Use a knife that is wider than the defect area to provide an even application over the entire defect.

3. Press firmly to completely fill any gaps and apply a second light coat over the area that is slightly higher than the original surface to allow for shrinkage during cure.

4. Allow the repair to cure for at least 45 minutes at room temperature. Hotter or cooler temperatures will vary the cure time.
5. When the putty is dry, sand the repair starting with 220 grit sandpaper and finishing with 400 grit sandpaper until it matches the original surface level.

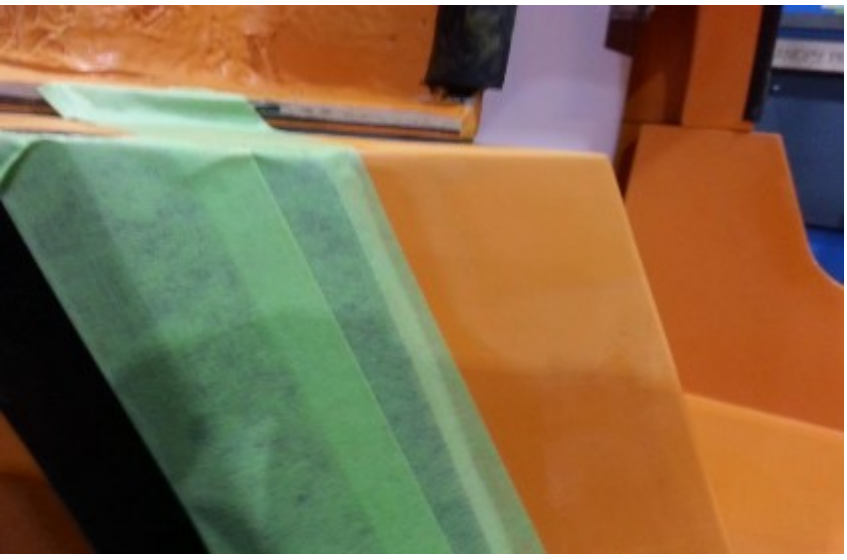


Figure 44: Sanded Gelcoat Putty Repair

6. Allow the repair to cure for 24 hours at room temperature before gelcoating and buffing.

Figure 45: Sanded and Cleaned Putty on Fiberglass Repair, Outside

Figure 46: Sanded and Cleaned Putty on Fiberglass Repair, Inside

5.11 Gelcoat Repair

NOTE

Gelcoat repair is time sensitive. Make sure that all materials and tools are present and ready for use when the application procedure is started.

All preparation must be completed on the repair spot, and tools and materials must be ready for use.

Apply the gelcoat as a surface finish when fiberglass and putty repairs are done.

Figure 47: Fiberglass Visible Through Putty Repair, Needing Gelcoat Repair

Use gelcoat repairs for:

- Covering putty and fiberglass repairs
- Shallow scratches and scuffs that do not go through the gelcoat
- Sealing a drilled hole
- Undercoat for clear coat refinishing

5.11.1 Colour Matching Gelcoat

Each gelcoat colour has a different code associated with it, which is documented both by Waterplay and by the water park operator.

Sometimes the gelcoat is sourced locally due to the difficulty of shipping dangerous goods by sea or air. In that case, make sure to get the correct colour code when locally sourcing it.

Other factors affecting colour match include:

- Catalyst levels – above 2.5% will cause a colour change
- Reducers – acetone will cause a colour change
- Temperature (Ambient and Cure) – too much heat will cause a colour change
- Gelcoat thickness – too thick or too thin will affect colour match
- Gelcoat mixing – must be very well mixed to provide uniform colour
- Buffing – gelcoat must be fully cured before buffing
- Blue colours are the most difficult to match and require the greatest attention to detail when making gelcoat repairs

5.11.2 PVA Partall Cure for Gelcoat

Gelcoat cures tack free when it is isolated from air.

PVA Partall is provided in the repair kits because it can help protect the gelcoat surface from the air while it hardens and cures. PVA Partall can be applied to the gelcoat surface in two
(2) ways:

- Mix it in (5%) with the gelcoat resin, pro patch, and catalyst and apply with a Preval sprayer. The Partall will come to the surface and form a protective layer while the gelcoat cures.
- Apply it with a brush or roller to the gelcoat surface after it has started to cure.

  It will protect the surface and help it cure tack free. Wash the Partall off the cured gelcoat surface with soapy water.

5.11.3 Mixing Gelcoat

1. Pour the desired amount of gelcoat into a mixing cup. Round up to an even amount to make for easier mixing calculations.

2. Pour an equal amount of Pro Patch into a second mixing cup.

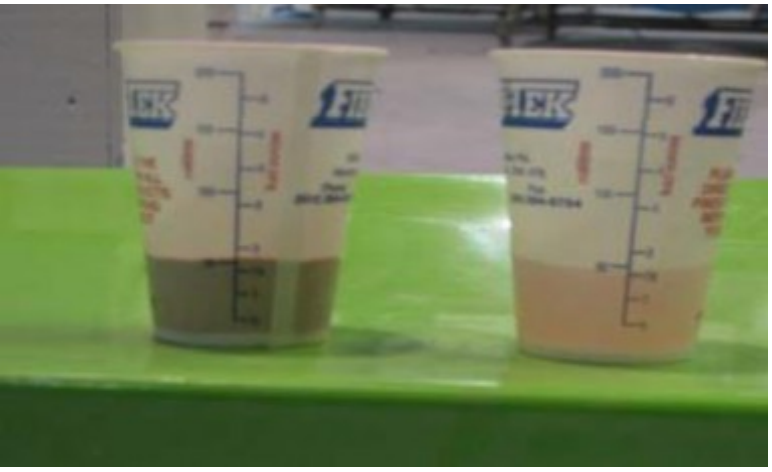


Figure 48: Pour Equal Gelcoat and Pro Patch Amounts

3. Add the Pro Patch to the gelcoat and mix well with a plastic or metal mixing stick. A clean putty knife will work as well.

Figure 49: Mix Gelcoat and Pro Patch

NOTE

Do not use wood as a mixing stick as wood can absorb catalyst and lower the catalyst ratio.

4. Note the final volume of the mixture and calculate the amount of catalyst required. The catalyst ratio must be between 1.5% and 2.5%.

For example, if you have 50ml of gelcoat and Pro Patch combined in a cup, and have chosen to use 2% catalyst, then you will need 1 ml of catalyst. (50ml X 0.02
= 1ml).

5. If using PVA Partall to protect the gelcoat surface while it cures, add about 5% to the mix and stir well.

6. Carefully add the catalyst and mix well again.

Figure 50: Add Catalyst

7. Add the catalyzed resin to the Preval spray paint jar.

Figure 51: Pour Mixture into Spray Paint Jar

8. Connect the tube to the bottom of the sprayer and the sprayer to the paint jar.

Figure 52: Connect Sprayer to Jar

5.11.4 Spraying Gelcoat

1. Hold the sprayer perpendicular to the surface and 30 to 35 cm (12 to 14”) away and press the spray nozzle.

Figure 53: Spray on an Even Coat

2. Spray up and down, then side to side in a crosshatch pattern on larger areas.

3. Spray until the repair is completely covered.

4. Spray an even thickness over the entire surface and be careful not to spray too heavily or the gelcoat will run.

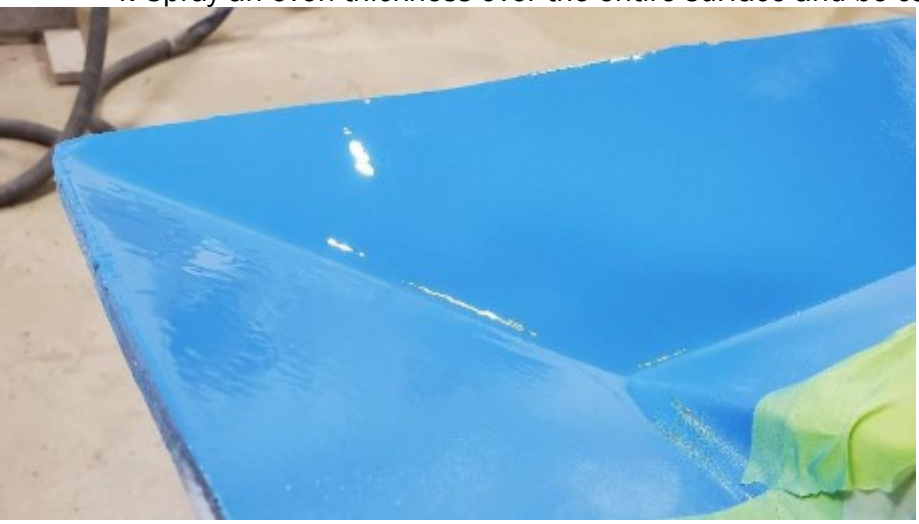


Figure 54: Spray the Entire Surface

5. Remove any masking tape and paper immediately after spraying and be careful not to disturb the fresh gelcoat with the masking material.

6. Allow the repair to fully cure (approximately 45 minutes).

7. After the gelcoat has fully cured, lightly sand with 400 to 600 grit sandpaper.

Figure 55: Sand with 400 to 600 grit Sandpaper

8. Proceed to buffing and sealing procedures for interior repairs, or clear coat procedures for exterior repairs.

Figure 56: Gelcoated Large Repair, Outside

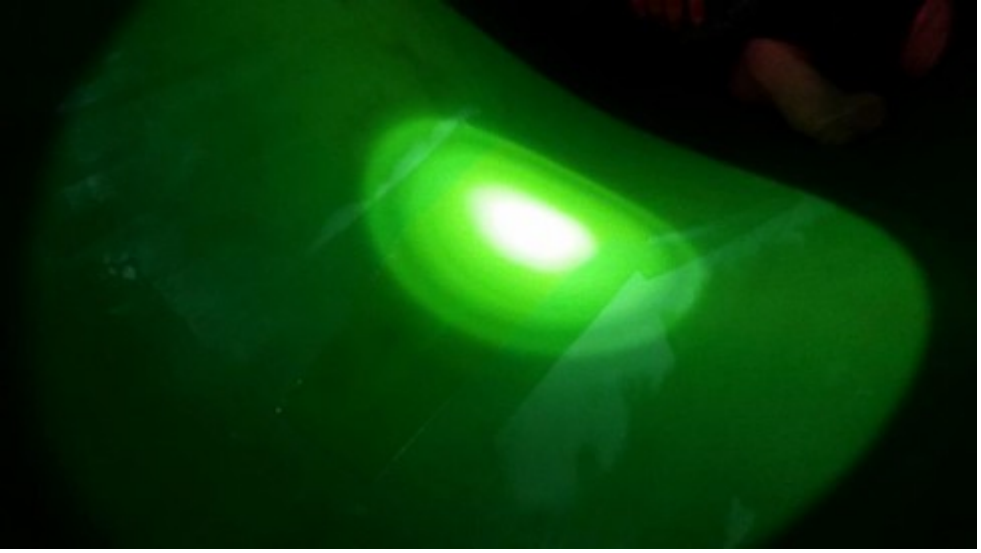


Figure 57: Gelcoated Large Repair, Inside

5.11.5 Sealing Holes with Gelcoat

Sometimes a new hole is drilled in FRP as part of on-site repairs. Whenever a hole is drilled in FRP, seal it with gelcoat to prevent water getting in the laminate.

1. Deburr the edges of the hole.
2. Use a small brush or swab to coat the exposed fiberglass with gelcoat.
3. Clean and store repairing equipment.
4. When the gelcoat has cured, use a bolt with a shank wherever possible.
5. If the bolt has exposed threads, use a plastic or metal sleeve and washers to protect the gelcoat finish on the edge. The image below shows the sleeve in red protecting the fiberglass from the bolt's threads.

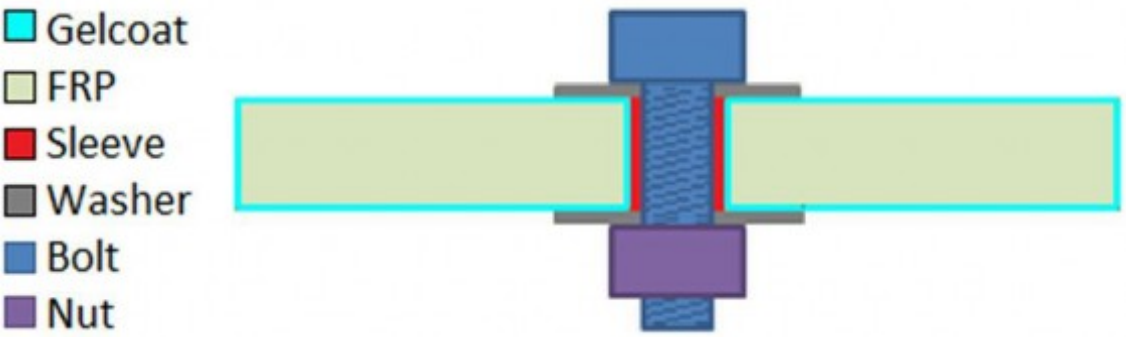


Figure 58: Adding a Sleeve to a Bolt

6. Apply a flexible polyurethane sealant to the drilled hole's surface before fastening washers, bolt, sleeve, and nut.
7. Wipe excess sealant away with clean cloth.

5.12 Barrier Coat Application and Repair

The following procedures are for an advanced Water Slide repair. Inexperienced staff must not attempt such repairs.

A vinylester barrier coat application between the gelcoat and the FRP is sometimes needed in pool entries and shutdown lanes that are rarely capable of fully drying. The barrier coat stops the water from entering the FRP through the gelcoat.

Gelcoat is engineered to let water flow through the coating in both directions, allowing it to fully dry after it has absorbed water. If the gelcoat surface is under water for long periods of time, it is not able to dry. The miniscule amount of water that passes through the gelcoat gets trapped in the FRP pores and causes bubbles and blisters.

Symptoms of barrier coat requirement include gelcoat separation from the FRP, blistering and bubbling and deforming the FRP surface.

Figure 59: Gelcoat Blisters Needing Barrier Coat

The following procedure describes the barrier coat application process.

1. Drain all water from the Water Slide surface and dry the surface.
2. Sand off the gelcoat surface to the FRP layer.

Figure 60: Sanded Gelcoat Ready for Barrier Coat

NOTE

If brushing/rolling gelcoat, allow one-hour dry time between coats as colours may blend together and discolour.

Blisters and bubbles where water has entered are commonly caused by pinholes in the FRP surfaces during manufacturing.

Figure 61: Pinholes in FRP Need Filling before Barrier Coat

3. With compressed air, ensure the sanded FRP surface is clean and all pinholes are empty of sanded particles.

4. Fill FRP pinholes with a polyester (gelcoat) or vinylester putty.

   Do not use any talc and plastic (Bondo) type filler in areas with high water saturation! Although commonly used in the field, Bondo aggressively absorbs water.

5. Sand until repair is flat and matches the profile of the slide.

Over sanding the fiberglass layer will cause more pinholes, requiring more filling and more sanding.

⚠CAUTION

6. Remove dust and debris and clean the surface with acetone.

7. Ensure that the pre-formulated barrier coat used is within the expiry time range.

8. Ensure that the barrier coat is prepared and applied within acceptable operating temperatures.

   Barrier coat application temperature is 15°C – 32°C (60°F – 90°F) Ideal temperature is between 21°C – 27°C (70°F – 80°F)

9. Add MEKP type initiator at 1.5% – 2.5% depending on the temperature.

10. Mix well and pour barrier coat into Preval sprayer.

11. Spray the barrier coat.

12. Ensure it is fully cured before continuing. Allow 30 to 45 minutes until it is tack- free. The coat is workable in around 60 minutes.

13. Wipe the cured barrier coat with acetone to remove any tacky residue.

NOTE

Barrier coat has a very thick viscosity and the uneven “orange peel” finish will need to be removed. The rougher sanded surface will also provide a better mechanical bond between the barrier coat and the gelcoat.

14. Sand the dried barrier coat smooth with sandpaper between 60 to 120 grit before applying gelcoat.

15. Remove dust and debris and clean surface with acetone.

16. Apply gelcoat and polish.

5.13 FRP Deformation Repair

The following procedures are for an advanced Water Slide repair. Inexperienced staff must not attempt such repairs.

1. The part is cut to relieve the pressure causing the deformation.

2. The inside is screwed to a thin sheet of plywood to set the shape of the curve.

Figure 62: FRP Deformation Repair Preparation

3. The cut edges are sanded away to prepare for fiberglass.

4. The fiberglass is laid up on the exterior until it is level.

Figure 63: FRP Deformation Repair Grinding and Fiberglass Application

5. The inside is repaired and gelcoated.

6. The outside is repaired, gelcoated, and clear coated.

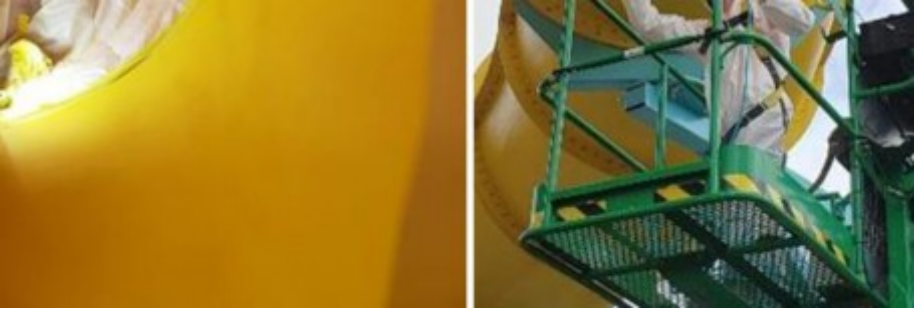


Figure 64: FRP Deformation Repair Gelcoat and Clear Coat Finishing

5.14 Buffing and Sealing

After gelcoat or gelcoat putty repairs or refinishing are complete, buff and seal the surfaces. Buffing and sealing are not required but is recommended.

Proper buffing technique is essential for good looking, seamless fiberglass repairs. An electric or pneumatic buffer can be used, and a wool buffing pad is recommended for best results. The following procedures are for an advanced Water Slide repair. Inexperienced staff must not attempt such repairs.

1. Before buffing, wait until the repair cures for a full 24 hours at 21° C (70° F) or two hours at 43° C (110°F).
2. Set the buffer speed between 2000 and 3000 RPM.
3. Clean the area to be buffed with a dry or isopropyl alcohol moistened cloth. Do not use water to clean the area.
4. Ensure no moisture or residue is left on the part surface.
5. Apply buffing compound to the buffing pad by starting the buffer and lightly pressing the polishing brick into the moving pad.

Figure 65: Apply Buffing Compound to Pad

6. Hold the compound on the pad until there is visible transfer of the buffing compound to the pad (the pad will change to the colour of the buffing compound).

   Be very careful when applying buffing compound; it is very important not to use too much pressure to the pad as the buffer can catch and kick back causing potentially serious injury.
7. Use a buffer speed of 2000 to 3000 RPM to buff the part.
8. Place the moving pad on the part surface and start the buffer.
9. Move the buffer side to side, then forward and back in a cross- hatch pattern over and around the repair area.

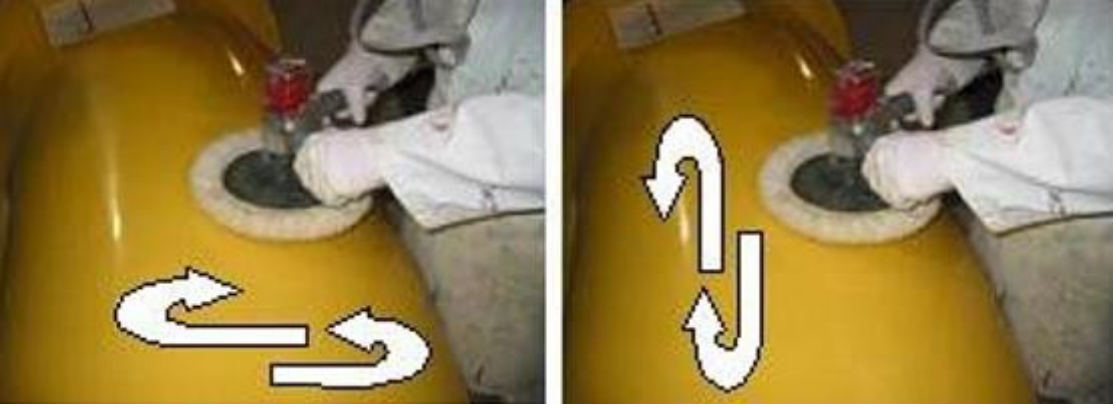


Figure 66: Move the Buffer Evenly and Constantly

It is very important to keep the buffer moving over the part surface at all times. If the buffer is left running in one spot on the part surface for more than one or two seconds it will generate high heat which can damage the gelcoat.

It is equally important not to use excessive pressure when buffing. The weight of the buffer will provide enough pressure to give a proper polish.

10. Buff until the repair surface finish matches the original surface finish.
11. If there are still sanding swirls on the surface, lightly re-sand the repair with 600 to 800 grit paper, then buff again.
12. When buffing is done, wipe off all excess compound with a clean dry cloth.

Figure 67: Buffed Small Putty Repair

Figure 68: Buffed Larger Repair, Inside

5.15 Clear Coat Finishing

The following procedures are for an advanced Water Slide repair. Inexperienced staff must not attempt such repairs.

Exterior FRP surfaces are coated with DC92 by BASF clear coat over the gelcoat or gelcoat putty repair to provide UV protection to the outside areas of slides and add a shiny finish.

⚠ DANGER

DC92 clear coat contains isocyanates and is:

- Toxic
- Corrosive

- Flammable
- Explosive

Refer to the product SDS for handling details.

Applicators must wear all applicable PPE to protect from chemical contact, mist, and fumes.

Use a fresh air hood for spraying, or NIOSH respirator when applying with brush or roller.

1. Wear all required PPE and be familiar with all chemical handling processes.
2. Access the FRP part with appropriate equipment for working at heights.

Figure 69: Use Proper Height Access and Fall Protection Equipment

⚠ DANGER

Fall Hazard

When working at heights, always use appropriate fall protection equipment and follow regional health and safety procedures.

3. Use an orbital sander and 180 grit paper to sand off the peeling clearcoat from the gelcoat surface, then finish with 220 grit.

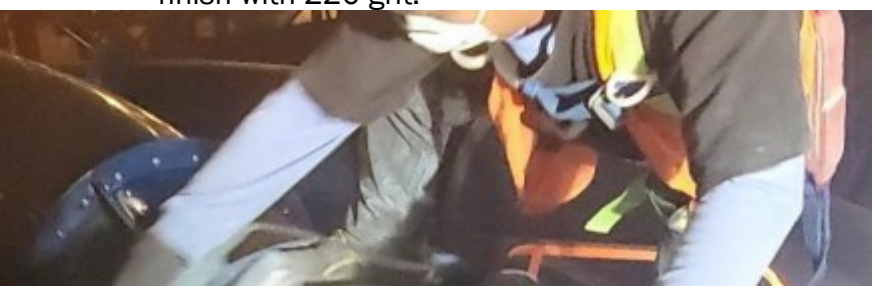


Figure 70: Sanding FRP for Clear Coat

4. Using PPE, wipe down sanded surface with 902 by BASF or similar wax and grease remover, spraying on with a pump sprayer and removing with new clean cotton rags or towels.

Figure 71: Wipe Sanded FRP with Wax and Grease Remover

5. When the surface is dry, spray a matching colour gelcoat base coat if it has not been done already. See Gelcoat Repair.
6. Mix the clear coat:
    - 3 parts DC92
    - 1 part LHF by BASF
    - 1 part UR50 by BASF
7. Pour into a Preval or larger compressed air sprayer, depending on the size of the area being clear coated.
8. Spray one medium coat of clear over the section, wait approximately 5 min, and apply one medium/wet final coat of clear.

Figure 72: Spray in Controlled Area with Full PPE

9. Avoid heavy coats, drips, and runs.

10. Inspect for drips or runs.

Figure 73: Inspect Finished FRP for Drips or Runs

Figure 74: Buffed and Clear Coated Large Repair, Outside