

ABN 98 000 869 367

563 Willoughby Rd. Willoughby 2068 Ph (02) 9958 5238 Fax (02) 9958 0838  
2 Lincoln St. Minto 2566 Ph (02) 9820 1144 Fax (02) 9603 2314  
188 Manns Road, West Gosford NSW 2250 Ph (02) 4322 0255 Fax (02) 4322 0266  
Unit 1 19 Boden Road Seven Hills NSW 2147 (02) 9674 7333 Fax (02) 9674 7377

## **A GUIDE TO SUCCESSFUL SURFACE PREPARATION**

For the successful application of any epoxy resin system, it is essential that careful consideration be given to the preparation of the surface, or surfaces to be coated or bonded.

Surface preparation methods are not only specific for the type of product being used, but also for the type of substrate to be treated.

It is with this criteria in mind that the following "Guide to Successful Surface Preparation" has been compiled.

### **BASIC OBJECTIVES:**

1. To remove all surface contaminates, loose surface deposits, and low strength material, to achieve a clean sound surface.
2. Once the surface has been prepared, care must be taken to avoid recontamination of the prepared surface.
3. Once prepared, it is good practice to apply the epoxy resin system as soon as possible to the cleaned surface.

### **BASIC METHODS EMPLOYED:**

1. Degreasing only.
2. Degrease, followed by mechanical abrasion, degrease again.
3. Degrease followed by chemical treatment.
4. Chemical treatment.
5. Mechanical treatment.

### **ACRYLIC:**

Degrease with a detergent solution. Roughen with emery cloth or by grit-blasting, and remove all dust particles with a dry-air blast or a non-clouding solvent such as methanol, or Industrial Methylated Spirits.

### **ALUMINIUM AND ALUMINIUM ALLOYS:**

Degrease. Abrade with emery cloth or by grit-blasting, and degrease again. Apply the epoxy resin system within 10 minutes of final degreasing.

Alternatively, degrease, and etch in a chromic acid / sulphuric acid solution made up as follows:

Pour 10-15 litres of clean water into an acid resistant container with a 50 litre calibration mark. While stirring, add 7.55 litres of concentrated sulphuric acid (s.g. 1.82) in a slow steady stream.

Add with continued stirring, 2.5kg of dry chromic acid (chromium trioxide)  $\text{CrO}_3$ , or 3.75kg of sodium dichromate ( $\text{Na}_2\text{Cr}_2\text{O}_7 \cdot \text{H}_2\text{O}$ ). Fill to the 50 litre mark with clean cold water. Immerse the part for 30 minutes at 60-60°C, then wash with clean cold running water, followed by clean \*hot water, then dry with \*hot air. Apply the epoxy resin system as soon as possible after pretreatment.

\*The temperature of the hot water and air must not be greater than 60°C.

4.5 litres of etching solution will suffice for about 20 square metres of aluminum surface.

NOTE: This procedure conforms to the U.K. Ministry of Technology Specification DTD 915B. A procedure for controlling the composition of the etch solution in continual use is included in this specification.

**ALUMINIUM, ANODIZED:**

Degrease thoroughly. Adhesion of the epoxy resin system will depend on the thickness, and structure of the oxide layer as well as on the type of pore sealer used. For bonds of maximum strength, it may often be necessary to abrade or etch the surfaces to be bonded.

**ASBESTOS BOARD:**

Degrease. Abrade, remove dust and degrease. Allow the board to stand a few minutes to ensure that all the degreasing agent evaporates out.

**BITUMINOUS SURFACES:**

The application of heavy duty epoxy resin compositions onto bituminous or asphaltic substrates is not normally recommended as the strength of such substrates is low.

However, where necessary, the bituminous surface may be cleaned by scrubbing the surface with stiff bristled brooms using a strong industrial detergent solution, followed by flushing the surface with copious volumes of clean water scrubbing with stiff bristled brooms. Allow the surface to dry thoroughly.

**BRASS:**

Degrease. Abrade with emery cloth or grit-blast, and degrease again.

**CADMIUM:**

Degrease. Abrade with emery cloth or grit-blast, and degrease. Apply the epoxy resin system as soon as possible after pretreatment.

**CAST IRON:**

Degrease. Grit-blast or abrade with emery cloth, and degrease again. Degrease cast iron until it no longer soils a white rag.

**CERAMICS, PORCELAIN:**

**Smooth surfaces:** Degrease. Abrade with carborundum / water slurry, wash with clean cold water, dry and degrease.

**Glazed surfaces:** Remove glaze by either etching, grit-blasting or with emery cloth, and degrease.

**Unglazed Earthenware:** Dry thoroughly, clean with a clean oil free wire brush, and remove all loose particles. Degrease.

**CHROMIUM:**

Degrease. Abrade by grit-blasting or with emery cloth, and degrease again.

Alternatively, etch in a solution of:

Concentrated hydrochloric acid (s.g. 1.18)     4.25 litres.

Water     5.00 litres

Immerse for 1 - 5 minutes at 90-95°C, wash with clean cold water, followed by clean hot water, and dry with hot air.

**CONCRETE:**

**New Concrete** should be cured for at least 28 days prior to applying an epoxy system. The concrete substrate should preferably be wood float finished, as this gives a fairly smooth surface with minimum development of laitance. (Laitance is hydration salts which bloom to the surface of the concrete as it sets, and can be seen as a white-light grey powdery substance which is loosely bonded to the body of the concrete, and therefore must be removed either by acid etching or mechanical means prior to applying the epoxy system).

a) **Acid Etching** is the easiest method of preparing new concrete as it effectively removes the laitance, and any loosely bonded fine aggregate from the surface.

Prior to applying the acid solution it is advisable to first dampen the new concrete with clean water. This will reduce the capillary effect of the concrete particularly if the surface is hot or shows signs of porosity.

A 15% hydrochloric (muriatic) acid solution is applied uniformly, a plastic watering can is ideal, at a rate of approximately 1 litre per square metre. The solution should be brushed well into the surface with stiff bristled yard brooms until all bubbling ceases.

**SPECIAL NOTE:** Ensure all operators involved in the acid etching process are wearing eye protection, gloves, and rubber knee boots.

Wash the spent acid residues from the surface with clean water again scrubbing the surface to remove any loose fine aggregate.

**NOTE:** At no time allow the spent acidic residues to dry on the surface. Should this occur, flush the surface with clean water and reapply the acid solution.

A final rinse of 1% solution of soda ash or baking soda should be applied at the same rate as the acid solution and again broomed into the surface. Finally, thoroughly flush down the surface with clean water and allow to dry.

Prior to applying the epoxy system, any residual fine surface dust or aggregate should be removed, preferably by vacuum-cleaning.

b) **Mechanical Methods:**

**Sand or Grit Blasting** may be carried out either wet or dry. In either case it is important to completely remove all residues from the surface by vacuuming followed by a clean water flush.

It is normal to remove about 1 - 1.5mm of the surface by sand blasting, and a fine profiled surface results.

**Scarifying** machines remove up to 3mm of the surface. Again all dust and debris must be removed from the surface.

Scarifiers tend to produce a highly profiled surface, and this should be taken into account when considering this method of preparation.

c) **Other Mechanical Methods:**

**Sanding** using high speed disc sanders with coarse sanding discs.

**Wire Brushing** is the least effective of all the above methods as in some cases the brush tend to polish the surface.

**Old Concrete:**

If the concrete has not been overlaid or painted, it may be treated in a similar manor to new concrete, however more emphasis has to be placed on removing any contaminants, and to the repair of any damaged, worn, or unsound areas.

**Paint** is not easily removed; sand blasting is the preferred method, but scarifying is also effective, particularly where surface finish is not a criteria.

**DO NOT USE PAINT STRIPPER TO REMOVE THE PAINT**

**Mineral Oils and Greases** are best removed by steam cleaning in conjunction with a suitable strong detergent solution. Thorough scrubbing with hot caustic solutions will also remove mineral oils and greases. However, should the substrate be porous, these contaminants prove extremely difficult to remove.

**Animal Fats** are extremely difficult to remove by any of the above mentioned methods. If the fats have penetrated deep into the concrete, the best method is to remove the contaminated concrete. The surface should then be treated as per new concrete.

Once the surface is dry, repairs to unsound areas may now be carried out using a suitable epoxy resin based concrete repair system.

The structure is now ready for the application of the final epoxy system.

## **COPPER AND COPPER ALLOYS** (Excluding Brass)

Degrease. Abrade by grit-blasting or with emery cloth and degrease.

OR

Etch in a solution of:

Ferric Chloride (FeCl <sub>3</sub> .6H <sub>2</sub> O) 42% solution	3.75 litres
Concentrated Nitric Acid (s.g. 1.42)	7.5 litres
Water	50.0 litres

Immerse for 1 - 2 minutes at room temperature, wash with plenty of clean cold water and dry promptly with a room temperature air stream. (The use of hot air may cause staining of the surfaces).

Bond immediately after pretreatment has been completed.

## **EPOXY RESIN MOULDINGS AND CASTINGS**

Abrade with emery cloth and degrease after removing all traces of release agents, especially silicones, with the appropriate solvent.

## **FOAM PLASTICS - POLYSTYRENE**

Sand down lightly if soiled, and remove all particles and dust. Do not clean with solvents.

## **FOAM PLASTICS - RIGID PVS, POLYURETHANE**

Sand down lightly to remove any residual release agent or soil. Remove all particles and dust with denatured alcohol.

## **GALVANIZED STEEL**

Degrease, abrade with emery cloth, and degrease.

Alternatively, degrease and etch in a solution of:

Concentrated hydrochloric acid	15 parts by volume.
Water	85 parts by volume.

Immerse for 2 - 4 minutes at room temperature, wash item with clean hot water, followed by clean cold water, and dry thoroughly in an oven at 60 - 70°C or with hot air.

NOTE: A suitable proprietary etch primer may also be used following degreasing of the surface.

Apply the epoxy resin system to the galvanized steel immediately after pretreatment has been completed.

## **GLASS AND SILICA**

Degrease thoroughly. Better still, grit-blast until matt or abrade with carborundum / water slurry, wash with clean water, dry and degrease.

Either heat for 30 minutes at 100°C, and apply the epoxy system before the glass cools to room temperature, or apply a silane primer at room temperature.

Alternatively, degrease and etch in a solution of:

Chromium trioxide	1kg.
Distilled water	5kg.

Immerse glass for 15 - 20 minutes, wash in distilled water, and dry for 20 - 30 minutes at 80 - 90°C.

## **GLASSFABRIC LAMINATES**

### **Epoxy / Glass**

Degrease, abrade with emery cloth or coarse steel wool, and degrease again.

### **Polyester / Glass**

Degrease, abrade down to the glass fibre with emery cloth, degrease with proprietary aqueous detergent, and dry.

## **GRAPHITE AND CARBON**

Degrease. Abrade with fine emery cloth and degrease. Make sure all traces of solvent have evaporated before applying the epoxy system.

## **LEAD, TIN, SOLDER**

Degrease. Abrade lead with emery cloth or coarse steel wool, then degrease until it no longer soils a white rag.

Degrease and lightly abrade tin, solder and tin-plated metal, then degrease again.

## **LEATHER**

Degrease. Roughen with glass-paper and degrease again. Allow to stand for a few minutes to ensure all degreasing solvent has evaporated.

## **MAGNESIUM AND MAGNESIUM ALLOYS**

Degrease. Abrade with emery cloth, degrease, and apply the epoxy system immediately.

**Alternatively:** Immerse for 5 minutes at 70 - 75°C in a solution of:

Caustic Soda 6.3kg.

Water 50 litres.

Wash with cold running water, then etch in a solution of:

Chromium Trioxide 5.0kg.

Water 50 litres.

Sodium Sulphate (anhydrous) 0.031kg.

Wash with cold water, followed by clean hot water, dry with hot air and apply the epoxy system immediately.

## **MELAMINE RESIN LAMINATES**

Abrade with emery cloth and degrease.

## **NICKEL**

Degrease. Abrade with emery cloth or grit-blast, and degrease again.

**Alternatively:** Etch for 5 seconds in:

Concentrated Nitric Acid (s.g. 1.42)

Wash with clean cold water, followed by clean hot water, and dry with hot air.

## **NYLON** (polyamide)

Degrease with a detergent solution. Roughen by grit-blasting or with emery cloth, and degrease again.

## **PAPER LAMINATES** (phenolic or melamine resin-bonded)

Abrade with emery cloth and degrease with solvent or proprietary detergent. Decorative laminates, and others are sometimes supplied abraded, and need only be degreased.

## **PLASTER**

Allow surface to dry thoroughly. Smooth with fine emery cloth and remove dust.

## **POLYESTER RESINS**

Degrease. roughen with emery cloth or coarse steel wool and degrease with acetone, or methyl ethyl ketone.

## **POLYETHYLENE AND POLYPROPYLENE**

See "Pretreatment of plastics".

## **PRECIOUS METALS**

Degrease gold, silver, and platinum. If this does not suffice, and if silver is tarnished (sulphides), abrade with fine emery cloth, and degrease again.

## **PRECIOUS STONES**

Degrease.

## **PTFE** (Teflon)

See "Pretreatment of Plastics".

## **PVE** (rigid)

Wipe with a clean cloth soaked with clean Trichlorethylene. Roughen with emery cloth and degrease.

See "Pretreatment of Plastics".

## **RUBBER**

Thoroughly roughening, and degreasing will sometimes suffice, but in most cases the following procedure will be necessary:

### **Natural Rubber**

Treat the surface for 5 - 10 minutes with concentrated sulphuric acid, wash clean with cold water, followed by clean hot water, and dry. Flex the rubber - the appearance of minute hair-line cracks on the surface indicates that it is ready for bonding. (The time of treatment with the acid will depend on the grade of rubber).

Vertical surfaces may be treated with a paste prepared by adding talcum powder to the concentrated sulphuric acid until it ceases to flow.

### **Synthetic Rubber**

Treat with concentrated sulphuric acid as for natural rubber. (The time required may be longer). If the surfaces feel very smooth or greasy, roughen them before treating with acid.

If minute surface cracks fail to appear on flexing, continue treatment using concentrated nitric acid until cracks do appear. Wash with clean cold water, followed by clean hot water, and dry.

**Note:** Silicone rubber and some other synthetic rubber / blends cannot be bonded with epoxy based systems.

## **STEEL, STAINLESS** (chrome steel, chrome-nickel steel)

Degrease. Abrade with non-metallic abrasives (e.g. emery cloth or grit-blast), and degrease.

The most effective degreasing agent is a solution of:

Sodium Metasilicate	1.0kg
Metasodium Phosphate	0.5kg
Sodium Hydroxide	0.5kg
Wetting Agent	0.15kg
Water	50 litres

To increase the strength of bonds, etch the stainless steel in a solution of:

Oxalic Acid	14.0kg
Concentrated Sulphuric Acid (s.g. 1.82)	12.2kg (6.7 litres)
Water	70 litres

Immerse for 10 minutes at 85 - 90°C, remove from the solution and flush under clean cold running water, brush off the black deposit with a clean stiff brush. Dry with hot air. Apply the epoxy resin system as soon as possible after pretreatment has been completed.

## **STEEL** (Ferrous)

Should be grit-blasted to a minimum class 2.5 "Near White Blast Clean". This approximates standard SA 2.5 of AS1627.9.

Following blast cleaning, all grit, dust, and other debris must be removed, and the surface degreased prior to the application of the epoxy system.

**Note:** The epoxy system should be applied as soon as possible following cleaning.

## **TITANIUM**

Degrease. Abrade with emery cloth or steel wool, and degrease again.

**Alternatively:** Either degrease with Carbon Tetrachloride, abrade with a rotary steel brush and degrease again; or

Degrease with Carbon Tetrachloride, etch for 3 minutes at room temperature in a 15% solution of Hydrofluoric Acid, wash off brownish deposit immediately, and dry.

**NOTE:** Special care must be taken when using Carbon Tetrachloride as it is a toxic substance and is readily absorbed both orally and through the skin.

### **TUNGSTEN AND TUNGSTEN CARBIDE**

Degrease. Abrade with emery cloth or grit-blast, and degrease.

**Alternatively:** Either etch for 10 minutes at 80 - 90°C in a solution of:

Caustic Soda (Sodium Hydroxide)	8.5kg
Water	20 litres

Wash with clean cold water, followed by clean hot water, and dry. Or, etch for 2 - 5 minutes at room temperature in a solution of:

Hydrofluoric Acid	25 grammes
Concentrated Nitric Acid	150 grammes
Concentrated Sulphuric Acid	250 grammes
Water	75 grammes

Wash and dry in an oven at 65 - 80°C.

### **WOOD**

Smooth with glass-paper. Ensure the wood is dry (moisture content not higher than 8 - 10%).

Wood free of natural oils, etc., requires no pretreatment other than the above.

### **WROUGHT IRON AND MILD STEEL**

Degrease. Grit-blast or abrade with emery cloth, and degrease again.

**Alternatively:** Etch in a solution of:

Orthophosphoric Acid (88%)	10 litres
Industrial Methylated Spirit	5 litre

Immerse for 10 minutes at 60°C, remove from the solution and flush under cold clean running water. Brush off black deposit with a clean stiff brush. dry in an oven or with hot air. Apply the epoxy system before rust can form.

### **ZINC AND ZINC ALLOYS**

Degrease. Abrade with emery cloth, degrease again, and apply the epoxy system immediately.

**Alternatively:** Etch like galvanized steel.

### **PRETREATMENT OF PLASTICS**

**Thermosetting Plastics:** Mouldings, castings, laminates, etc. can usually be bonded, or coated without difficulty. To ensure good bond strength, all soil and residual release agent must be removed from the surfaces before the epoxy system is applied. The surfaces must either be abraded with emery cloth, grit-blasted, or be cleaned with a solvent such as Acetone, Methyl Ethyl Ketone, etc. Abrading or grit-blasting is recommended for mouldings since their surfaces may otherwise repel the epoxy system.

**Thermoplastics:** these are often difficult to bond or coat. Certain types permit only moderately successful bonding, and one and the same material may show considerable variation in properties determining the strength of the bond. Special adhesives have been developed, however, they usually prove to be ineffective when thermoplastics have to be bonded to materials such as wood, metal, etc. Polymer Epoxy Adhesives can be used in such cases even though their suitability for bonding some thermoplastics is only limited.

**Pretreatment of Plastics** by the following methods has been found to give good to excellent bond strengths. However, since the grade of plastic, and the manufacturing process used to make the component, may affect the optimum application time of the chemical pretreatment, it would be advisable to establish by trial whether the specified time needs to be adjusted.

ABS plastics ) Abrade with emery cloth  
 Polycarbonates (e.g. Makrolon) ) or grit-blast. Remove  
 Polymethyl Methacrylate (e.g. Perspex) ) dust with Methanol or  
 Polystyrene ) Industrial Methylated  
 Polyvinyl Chloride (rigid) ) Spirit.

Acetal Resins (e.g. Delrin, Hostaform C) )  
 Diallylphthalate Resin (e.g. Dapon) )  
 Epoxy Resins ) Abrade with emery  
 Urea Resins ) cloth or grit-blast.  
 Melamine Resins ) Degrease with  
 Phenolic Resins ) Acetone to remove  
 Polyamides (e.g. Nylon, Ultramid, etc.) ) dust.  
 Polyester Resins )  
 Polyphenylene Oxide )  
 Polyurethanes )

Chlorinated Polyethers (e.g. Penton) ) Degrease with  
 Polyethylene ) Acetone and etch

Page 09

Technical Data Sheet - Surface Preparation

Polyformaldehyde ) in a solution  
 Polypropylene ) of:

Concentrated Sulphuric Acid (s.g. 1.82) 3.0kg (1.65 litres)  
 Potassium Dichromate 0.25kg  
 Water 0.15kg

<b><u>Plastic</u></b>	<b><u>Immerse for</u></b>	<b><u>at °C</u></b>
Chlorinated Polyethers	about 5 minutes	70
Polyethylene	10 - 15 minutes	25
Polyformaldehyde	10 - 20 seconds	25
Polyphenylene Oxide	5 - 15 seconds	70
Polypropylene	1 - 2 minutes	70

After immersion, wash surfaces with clean cold water and dry carefully.

**Alternatively:** Burn off the joint surface by moving them through a blue, not yellow, Bunsen or acetylene flame until they appear smooth and polished. Do not overheat or melt the plastic.

**ABS PLASTICS** (acrylonitrile-styrene)

Degrease with detergent solution and etch in a solution of:

Concentrated Sulphuric Acid (s.g. 1.82) 14.0 litres  
 Potassium Dichromate 0.2kg  
 Water 5.0 litres

Immerse for 5 - 20 minutes at 20 - 60°C, wash with clean cold water, followed by clean hot water, and dry with hot air.

## **ACETAL RESINS** (e.g. Delrin, Hostaform C, etc.)

Degrease and etch for about 20 seconds in a solution of:

Concentrated Sulphuric Acid (s.g. 1.82)	3.0 litres
Potassium Dichromate	0.15kg
Water	0.24 litres

Wash with clean water and dry.

**Alternatively:** Either degrease and etch for 5 - 10 seconds at 90 - 100°C in a solution of:

Perchloroethylene	96.0 parts by weight
Dioxane	3.7 parts by weight
p-Toluene Sulphonic Acid	0.3 parts by weight

Then heat in an oven for 30 - 60 seconds at 100 -120°C, wash thoroughly with hot water at about 60°C, and dry.

OR burn off like polyethylene.

## **PTFE** (Teflon)

Degrease and etch in a solution made up as follows:

Pour 2 litres Tetrahydrofurane into a three-necked flask fitted with a Calcium Chloride tube and mixer. In it dissolve 256 grams Napthalene, then add 46 grams fragmented Metallic Sodium. The sodium will take about 2 hours to react with the naphthalene. The solution will then be brownish black in colour and ready for etching PTFE. It will keep for 2 to 3 months in a sealed container.

Immerse the PTFE surfaces for about 15 minutes at room temperature, then wash them with Acetone, followed with clean running water, and dry thoroughly. The dry, etched PTFE will be brown in colour.

Various chemical pretreatments described above were copied from the following and other publications:

Charles V. Cagle, Adhesive Bonding (McGraw Hill Book Company, New York)

### **SPECIAL NOTE:**

**Solvents:** Organic solvents must be handled with care since their use raises a fire and/or toxic hazard. The appropriate handling precautions should be ascertained and strictly followed.

**Acids and Caustic Soda:** Concentrated acids and hot caustic soda solutions are aggressive chemicals. It is advisable to wear goggles and protective clothing when handling them. Never pour water into acids. Always pour the acid slowly into the water, stirring all the while.

### **WARRANTY**

Fiberglass A/Asia Sales Pty. Ltd. warrants that this information is furnished without guarantee or warranty expressed or implied, including warranties of fitness for a particular purpose. No statements or recommendations contained herein are to be construed as inducements to infringe any relevant patent now or hereafter in existence.

Fiberglass A/Asia Sales Pty. Ltd. shall not assume any legal responsibility for incidental, consequential, or other damages resulting from user negligence.