TECHNICAL NOTE

SURFACE PREPARATION GUIDE

For high strength structural bonds, paint, oxide films, oils, dust, mould, release agents and all other surface contaminants must be completely removed. However, the amount of surface preparation directly depends on the required bond strength, environmental aging resistance and economic practicalities. There are three basic methods of removing contaminants: chemical cleaning, abrasion and degreasing.

CHEMICAL CLEANING is popular for preparing metals. It includes treatments that etch the surface to form highly adhering oxides, or deposit complex inorganic coatings. Chemical cleaning, where applicable, provides the best surface for adhesion.

ABRASION METHODS include sandblasting, vapor honing and use of abrasives or "Scotch-Brite" cleaning and finishing materials. Sandblasting with fine sand can only be used on substrates sufficiently thick to prevent distortion. Vapor honing is satisfactory when minimum reduction is desired in metal thickness. In this method, powered abrasive material is propelled by high velocity water or steam against the surface.

DEGREASING may be used when maximum adhesive strength or outdoor weather-resistance is not critical. Surfaces are cleaned with either a hot alkali solution or solvent vapor. To use either method, surfaces must be free of rust, paint and mill scale.
Hot alkali solution is the most effective in removing residual contaminants. Solvent vapor systems are less effective and should be checked frequently for accumulated contaminants.

RECOMMENDED SURFACE PREPARATION PROCEDURES FOR BONDING

The following surface treatments are recommended for preparing various materials for bonding.

For precious metals and jewels, degreasing will be satisfactory, with the possible exception of silver where the tarnish should be removed with medium grit emery paper. A stabilized Trichlorethylene vapor phase degreaser is recommended.

Most plastic parts will have residual mold release or wax on the surface; before bonding, impurities should be removed with a suitable solvent such as Acetone or Methyl Ethyl Ketone and abraded lightly with a medium-grit emery paper.

When abrading, the use of medium-grit blasting is recommended. After grit blasting, parts should be degreased again before bonding. In all cases, parts should be bonded as soon as possible after pre-treatment. If bonding must be delayed, we recommend that the parts be covered with a light tissue paper and stored in a non-contaminating, dry atmosphere.

Following are several chemical pre-treatment formulas recommended for the most common adherents. All recommendations are for industrial use only and are made without guarantee.

ALUMINUM, ALCLAD OR 24ST

1) Degrease with a solvent and dry.
2) Clean surface with a chromic acid solution by immersion at 65-70 C for 5-10 minutes.
3) Rinse the metal thoroughly with clear running water and dry.
4) For best results, parts should be coated or bonded immediately.

Prepare the chromic acid solution as follows:
10 parts/wt. Sodium Dichromate + 30 parts/wt. 96% Sulfuric Acid + 100 parts/wt distilled water. Dissolve the Dichromate in most of the water, add Sulfuric Acid, stirring carefully and then add the remaining water.

CAST IRON

Degrease. Grit-blast or abrade with emery paper. Degrease again.

CONCRETE (Portland Cement Type)

Concrete contaminated with oil or grease must first be scrubbed with a caustic solution such as Ammonium Hydroxide followed by a thorough flushing with water. New or old concrete should be prepared for bonding by one of the following methods:

A) Sandblast about 1/16" from the surfaces to be bonded and remove dust preferably by vacuum. Where the concrete surface has deteriorated, grind or cut down to good material and remove dust.

B) Remove about 1/8" from the surface by mechanical scarification and remove dust.

C) Chemically etch with a 15% by weight Hydrochloric Acid solution (1 gallon to every 5 square yards spread with stiff bristle street brooms) until bubbling subsides (~15 minutes). Wash with clean water using high-pressure hose until all slush is removed. If an acid condition persists, as indicated by moist litmus paper, a rinse of 1% by weight Ammonia solution should be applied followed by a final flush. Allow surface to dry thoroughly.

COPPER AND ITS ALLOYS (Brass)

Prepare a solution 430 parts/volume Sulfuric Acid + 72 parts/volume Nitric Acid + 490 parts/volume water.

Procedure: Dip 15 seconds in above solution, rinse in running tap water (25C) for 5 seconds, dip in 15% (volume) Hydrochloric Acid, followed by a 2-minute rinse in running tap water (25C).

DIALLYL PHTHALATE

Degrease with a rag containing Acetone or M.E.K. Abrade the surface with medium-grit emery paper. Degrease again with Acetone or M.E.K.

GALVANISED OR ZINC FINISHED METALS

Degrease. Abrade with medium-grit emery paper. Degrease again or use the following etching procedure:

Prepare a solution of 20 parts/wt. concentrated Hydrochloric Acid + 80 parts/wt. distilled water. Degrease parts then immerse the metal in the solution for 2-4 minutes at room temperature. Rinse in cold running, distilled or de-ionized water. Dry in an oven for 20-30 minutes at 60-70 degrees C. Apply adhesive as soon as possible.

GLASS
For normal bonding applications, degreasing alone is sufficient for pre-treating glass surfaces. Grit blasting with very fine grit until the surface appears frosted can be used to achieve optimal adhesive strength.

LEAD
Degrease. Abrade with medium-grit emery paper. Degrease again.

LEATHER
Degrease with Acetone or Methyl Ethyl Ketone. Roughen with sandpaper and degrease again.

MAGNESIUM AND ITS ALLOYS
A) Vapor degrease with stabilized Trichlorethylene.
B) Immerse in 10% Sodium Hydroxide for 10 minutes at 76-87C.
C) Rinse 5 minutes in a cold-water spray.
D) Immerse in a solution of 1 1/2 lbs. Chromic Acid, 1/4 lb. Sodium Nitrate in 1 gallon of water for 8 minutes at room temperature.
E) Rinse approximately 3 minutes.
F) Immerse in a 20% solution of Hydrofluoric Acid for 5 minutes at room temperature.
G) Rinse for 30-60 seconds.
H) Immerse in a boiling solution of 10-15% Sodium Dichromate and 0.15% Calcium Fluoride for 30 minutes.
I) Rinse 1-2 minutes.
J) Dry in hot air blast (71-98 degrees C) for 10 minutes.
K) Bond immediately or apply a Zinc primer for protection of freshly etched surfaces.

SILICONE STEEL
Prepare a solution of 8.0 parts/wt. Hydrochloric Acid + 7.8 parts/wt. Sulfuric Acid + 84.2 parts/wt. Nitric Acid.

Parts should be immersed in the above solution (maintained at 70-75C) for 10-20 minutes, then rinsed with water at room temperature and brushed with a soap solution to mechanically remove scale loosened by the chemical bath. A hot water rinse at 70-75 C followed by a hot air dry at 70-75 C completes the preparation.

STAINLESS STEEL
Use Aremco's Corr-Prep CPR2000 zinc phosphate solution and follow label instructions.

TEFLON
Formulas for etching solutions are available, however, because of the danger in the preparation and use of these materials, we recommend that you buy proprietary materials available from the companies listed below:

W.L Gore Associates, Newark Delaware - (Tetraetch)
Acton Associates, Newark New Jersey - (Fluoroetch)
Joclin Manufacturing Co. Wallingford, Conn. - (Fluorobond)

Teflon and other fluorocarbon plastics are available in bondable form from many suppliers.

PHENOLIC, POLYESTER & POLYURETHANE RESINS
Degrease with Acetone or Methyl Ethyl Ketone. Abrade with medium-grit emery paper. Degrease again.

RUBBER
Surface etching of rubber is recommended for maximum bond strength. A satisfactory bonding surface can be obtained using the following cycling technique:

Immerse the rubber in concentrated Sulfuric Acid (1.84 g/cc) for 5-10 minutes in the case of natural rubber and 10-15 minutes in the case of synthetic rubber. Many rubbers are very acid resistant and will require longer cycling times to reach a point where the rubber will have fine cracks when flexed.

Alternatively, a paste of concentrated Sulfuric Acid and Barytes can be used. The paste is made by adding Barytes to the acid to give a consistency that will not run. After washing thoroughly with water and drying, the brittle surface of the rubber should be broken by flexing so that a finely cracked surface is produced. It may be necessary to wash with dilute caustic solution to insure neutralization of residual acid which, if not removed, will consume some of the curing agent weakening the bond strength. The surface is then ready for application of the adhesive.

TIN
Degrease. Abrade with medium-grit emery paper. Degrease again.

TITANIUM
In general, an acid etch is the most effective surface treatment for titanium. Anodizing in 15% Sulfuric acid or etching in hot Sulfuric acid solution followed by cleaning in Alkanex detergent-Sodium Metasilicate solution produces good results. Still better results are obtained if the titanium surface is first plated with a metal such as aluminum or nickel.

WOOD

Remove any contaminating materials such as oil, rot, etc., with a sander, ax, or plane. Make certain the wood is dry. Smooth with sandpaper.