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.

Removing Contaminants

There are three basic methods of removing contaminants: chemical cleaning, abrasion and degreasing.

Chemical cleaning is popular for preparing metals. It includes treatments which 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, vapour 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. Vapour 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 vapour. 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 vapour 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. In general, these three steps are necessary for cleaning any surface.

1. Degreasing
2. Chemical etching or mechanical abrading
3. Cleaning

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

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

When mechanically abrading, we recommend the use of medium-grit blasting. It is essential, when parts are grit or sandblasted, that they 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.

Pre-Treatment Formulas

Following are several chemical pre-treating formulas recommended for the most common adherents (for industrial use only). All recommendations or suggestions for use are made without guarantee - as conditions of use are beyond our control.

Aluminium, Alclad or 24st

1. Degrease with a solvent and dry.
2. Clean the surface with a chromic acid solution (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).
3. Rinse the metal thoroughly with clean running water and dry well. (If compressed air is used, extreme care should be taken to see that no oil is sprayed on the surface from the compressed air system). For best results, parts should be coated or bonded immediately.

Cast Iron

1. Degrease.
2. Grit-blast or abrade with emery paper.
3. Degrease again.

Concrete (Portland Cement Type)

1. 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.
2. New or old concrete should be prepared for bonding by one of the following methods:

    - Sand-blast about 1/16” from the surfaces to be bonded and remove dust preferably by vacuum cleaner. Where concrete surface has deteriorated, grind or cut down to good material and remove dust.
    - Remove about 1/8” from the surface by mechanical scarification and remove dust.
    - 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 (about every 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)

- 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) five seconds, dip in 15% (volume) Hydrochloric acid, followed by a 2 minute rinse in running tap water (25C).

The following formula may be used:

- 8.0 parts/wt. Ferric chloride solution.
- 16.3 parts/wt. Nitric Acid.
- 75.7 parts/wt. Water

Immerse the parts 1-2 minutes at room temperature, followed by a thorough water rinse and air dry at 60-65C.

Diallyl Phthalate

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

Galvanised or Zinc finished Metals

1. Degrease
2. Abrade with medium-grit emery paper.
3. Degrease again or use the following etching procedure: 20 parts/wt. concentrated Hydrochloric Acid, 80 parts/wt. distilled water.

Treat as follows:

1. Degrease
2. Immerse the metal in the Hydrochloric Acid for 2-4 minutes at room temperature.
3. Rinse in cold running, distilled or de-ionised water.
4. Dry in an oven for 20-30 minutes at 60-70 degrees C.
5. Apply adhesive as soon as possible.

Glass

For normal bonding applications, degreasing alone is sufficient for pre-treating glass surfaces. If, however, the very optimum in strength is required, the glass can be grit-blasted with very fine grit until the surface appears frosted.

Lead

1. Degrease
2. Abrade with a medium-grit emery paper.
3. Degrease again.

Leather

1. Degrease with a rag containing Acetone or M.E.K
2. Roughen with sand paper.
3. Degrease again.

Magnesium and its Alloys

1. Vapour degrease with stabilised Trichlorethylene.
2. Immerse in 10% Sodium Hydroxide for 10 minutes at 76-87C.
3. Rinse 5 minutes in a cold water spray.
4. Immerse in a solution of 1 1/2 lbs. Chronic Acid, 1/4 lb. Sodium Nitrate in 1 gallon of water for 8 minutes a room temperature.
5. Rinse approximately 3 minutes.
6. Immerse in a 20% solution of Hydrofluoric Acid for 5 minutes at room temperature.
7. Rinse 1/2 - 1 minute.
8. Immerse in a boiling solution of 10-15% Sodium Dichromate and 0.15% Calcium Fluoride for 30 minutes.
9. Rinse 1-2 minutes.
10. Dry in a hot air blast (71-98 degrees C) for 10 minutes.
11. Bond immediately or apply a Zinc primer for protection of freshly etched surfaces.

Silicone Steel

8.0 parts/wt. Hydrochloric Acid
7.8 parts/wt. Sulfuric Acid
84.2 parts/wt. Nitric Acid.

1. Immerse in the above solution (maintained at 70-75C) for 10-20 minutes
2. Rinse with water at room temperature and brush with a soap solution to mechanically remove scale loosened by the chemical bath.
3. A hot water rinse (70-75 degrees C) followed by a hot air dry (70-75 degrees C) completes the preparation.

Stainless Steel

1. Degrease
2. Etch for 10 minutes at 65-69 degrees C in a solution. (90 parts/wt. Water, 37 parts/wt. 96% Sulfuric Acid, 0.2 parts/wt. Nacconol NR (National Aniline).
3. Rinse in tap water or distilled water.
4. Immerse for 10 minutes at room temperature in a water solution. (88 parts/wt. Water, 15 parts/wt. concentrated Nitric Acid, 2 parts/wt. Hydrofluoric Acid).
5. Rinse in distilled water and dry in 95 degrees C. oven.

Phenolic, Polyester and Polyurethane Resins

1. Degrease with a rag containing Acetone or M.E.K.
2. Abrade with medium-grit emery paper.
3. Degrease again.

Rubber

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

Immerse the rubber in concentrated Sulfuric Acid (sp. gr. 1.84) 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 cyclising 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 which 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 neutralisation 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

1. Degrease.
2. Abrade with medium-grit emery paper.
3. Degrease again.

Titanium

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

Wood

1. Remove any contaminating materials, such as oil, rot, etc., with a sander, ax, or plane.
2. Make certain the wood is dry.
3. Smooth with sand-paper.