Araldite® Bonding

Surface preparation and pretreatments

Working directions for the surface preparation essential for optimum adhesion between structural materials bonded with Araldite adhesives.

Araldite adhesives form extremely strong and durable bonds with metals, glass, rigid plastics, rubber and many other materials. Designers in every sphere of industry increasingly find that bonding with Araldite provides the answer to production problems posed by new materials, new uses of existing materials, and new techniques and manufacturing methods.

HUNTSMAN

Introduction

Araldite resins adhere firmly to most materials. Bonds of great strength are obtained after removal of grease and loose surface deposits, e.g. rust, from the surfaces to be joined, but when maximum strength is required a more thorough mechanical or a chemical pretreatment is recommended.

Materials to be bonded

Listed on the back cover of this manual are the materials for which pretreatments are given. Bonding these materials comprises the main part of high-strength adhesive work and consequently their pretreatments are the most in demand. Materials less commonly used and not specifically dealt with in this manual may require only simple degreasing and abrading (as described below) but if other pretreatments appear necessary advice should be obtained from Huntsman Advanced Materials.

Surface preparation

Surfaces are prepared by one of the following pretreatment procedures (listed in order of increasing effectiveness).

1. Degrease only.
2. Degrease, abrade and remove loose particles.
3. Degrease and chemically pretreat

Care must be taken to avoid contaminating the surfaces during or after pretreatment. Wear clean gloves. Contamination may be caused by finger marking – or by cloths which are not perfectly clean – or by oil – contaminated abrasives – or by sub-standard degreasing or chemical solutions. Contamination may also be caused by other work processes taking place in the bonding area. Particularly to be excluded are oil vapours from machinery, spraying operations (paint, mould release-agent, etc.) and processes involving powdered materials.

This instruction manual is divided into the following parts:

Whatever the pretreatment procedure used, it is good practice to bond the surfaces as soon as possible after completion of the pretreatment – i.e. when surface properties are at their best.

Note If the scheduling of bonding operations on multi-part assemblies causes delay between pretreatment and bonding, optimum surface properties may be preserved by priming the bond surfaces immediately after pretreatment.

Part 1 - Degreasing

The removal of all traces of oil and grease from the surfaces to be bonded is essential. Degreasing by one of the four methods given below should be carried out even when the surfaces to be bonded appear clean.

Degreasing methods

Remove all traces of oil and grease as follows:

(a) Suspend in halocarbon solvent *vapour in a vapour degreasing unit. The unit may include a compartment to enable initial washing in the liquid solvent.

or

where a vapour degreasing unit is not available:

(b) Immerse successively in two tanks each containing the same liquid halocarbon solvent. The first tank acts as a wash, the second as a rinse. When the solvent in the wash tank becomes heavily contaminated, the tank is cleaned out and refilled with fresh solvent.

***Halocarbon solvents** Trichloroethylene is the dominant halocarbon solvent for vapour degreasing. Its toxicity necessitates the use of suitably designed plant. At the time of publication, legislation regarding halogenated solvents was changing. Users should contact the solvent suppliers for advice and must ensure compliance with local and national regulations governing their use. See Part 5 – Caution.

This tank is then used for the rinse, and the former tank for the wash.

or

(c) Brush or wipe the joint surfaces with a clean brush or cloth soaked in clean halocarbon solvent or other proprietary commercial degreasing solvent. (For fine work, washing down with solvent applied by aerosol spray may be a more suitable alternative; this technique also ensures that the solvent used is clean.) Allow to stand for a minute or two to permit complete evaporation from the joint surfaces.

A wide range of proprietary solvent degreasing agents with low hazard ratings are now available. These should be used according to the manufacturers' instructions

Note Certain plastics and rubbers are attacked by solvents such as trichloroethylene. These plastics may be degreased with detergent solutions, alcohols such as isopropanol, ketone solvents, or proprietary solvent degreasing agents, depending on the type of plastic.

or

(d) **Detergent degreasing** Scrub the joint surfaces in a solution of liquid detergent. Wash with clean hot water and allow to dry thoroughly – preferably in a stream of hot air from, e.g. a domestic forced-air heater.

Note Non-ionic detergents give generally good results.

(e) **Alkaline degreasing** is an alternative method to the detergent degreasing.

The ingredients may be selected from a wide range of compounds including sodium or potassium hydroxide, carbonates, phosphates, borates, complexing agents and organic surfactants. They can be used hot or cold with or without applied current. There should be very thorough washing, and possibly neutralisation to remove residual traces of alkaline cleaners. It is recommended to use proprietary products and follow manufacturers' instructions for use.

(f) **Ultrasonic degreasing** may be employed when appropriate and is generally used for the preparation of small specimens.

Warning Safety precautions must be observed where halocarbon solvents are in use. See Part 5 – Caution.

Test for a clean bond surface

The water-break test is a simple method to determine whether the surface to be bonded is clean. It is best suited to metals. If a few drops of distilled water applied to the surface, wet the surface and spread – or if, on drawing the surface from distilled water, the water film does not break up into droplets – then the surface may be assumed to be free of contamination. Uniform wetting of the surface by distilled water indicates that it will probably be likewise wetted by adhesive.

It must be borne in mind that certain plastics, even when clean, may not be wetted by distilled water, but will be wetted by adhesive. Furthermore, satisfactory wetting gives no information as to the potential bond strength. At most it is a necessary – but not sufficient – requirement for the achievement of high bond strengths.

Part 2 - Abrading

Lightly abraded surfaces give a better key to adhesives than do highly polished surfaces. Abrasion treatment, if carried out, must be followed by a further treatment to ensure complete removal of loose particles. For example:

(a) Repeat the degreasing operation (degreasing liquids must be clean), or

(b) Lightly brush with a clean soft brush, or-preferably

(c) Blow with a clean dry (filtered) compressed-air blast.

Metal surfaces

Remove surface deposits, e.g. tarnish, rust or mill scale, preferably by blasting with sharp grit*. If grit-blasting equipment is not available or the metal is too thin to withstand blast treatment, then clean the joint surfaces with a wire brush, or with abrasive cloth or water-proof abrasive paper (alumina or silicon carbide abrasive, from 46 to 120 mesh). Wetting the wire brush – or the abrasive cloth or paper – assists removal of contaminants and reduces dust. Dry, if necessary, and remove all loose particles.

Note Painted surfaces should be stripped of paint; otherwise the strength of the joint may be limited by comparatively low adhesion to metal.

*For most materials the preferred grits are fused alumina and, less commonly, silicon carbide (ferrous grits such as chilled iron must be restricted to mild steels and cast irons; their use on other metals may promote corrosion). Fused alumina is the abrasive almost invariably used for aluminium alloys and stainless steels. Silicon carbide is sharper, but it is more expensive and also more friable. Silicon carbide is used on certain special alloys liable to react adversely with any residual fused alumina at temperatures they may encounter in service. The use of silicon carbide can be advantageous when the materials to be abraded are either soft or extremely hard. Choice of grit size depends on various factors: the metal to be grit-blasted, the type of grit-blasting equipment, the pressure and angle of blast impact, and the time of treatment. Grits in the range of 46 to 120 mesh are suitable, but the optimum grit size for the work in hand can be determined only by trials. In general for soft materials the optimum grit size will be towards the fine end of the range.

Plastics and glass surfaces

Remove the surface layer of plastics surfaces to ensure elimination of all traces of release agent. As with metals, abrasion by grit-blasting (see notes on page 3) is in general the best method; the alternative is to use abrasive cloth or paper. After abrasion, remove all loose particles.

Note Removal of loose particles from plastics surfaces is best carried out by methods (b) or (c) above. Use of degreasing liquids on certain plastics may impair the key produced by the abrasion treatment.

Since plastics are poor heat conductors, care must be taken to keep blasting times as short as possible.

For pretreatment of composite materials cryoblasting may also be used which involves use of solid carbon dioxide pellets as the blasting medium.

Part 3 - Pretreatments for particular materials

Most materials likely to require bonding in industrial practice are dealt with individually in the following pages – for index, see page 20. Engineers contemplating the bonding of materials not covered by this manual are invited to submit enquiries concerning appropriate pretreatments to our technical staff.

Special pretreatments for maximum bond performance

The surface preparation described above, i.e. degreasing alone or degreasing followed by abrasion and removal of loose particles, is sufficient for most adhesive work.

But to obtain maximum strength, reproducibility and long-term resistance to deterioration, a chemical or electrolytic pretreatment may be required – and examples of these special pretreatments are printed in blue in the following pages.

Metal adherend surfaces are rarely of pure metal, but are a combination of oxides, suphides, chlorides and other atmospheric contaminants resulting in a surface which is mechanically weak. Acid etching is a well-established method of removing metallic scale, in favour of forming an oxide layer which is mechanically and chemically compatible with the adhesive. Hence, different acid treatments are applied to different metal adherends, for example, chromic acid for aluminium, sulphuric acid for stainless steel, and nitric acid for copper. Acid pretreatment can also be applied to certain plastics, e.g. chromic acid is used to surface treat polyolefins.

Anodising has been exploited extensively by the aerospace industry as a surface pretreatment for aluminium and titanium alloys. The purpose of anodising is to deposit a porous oxide layer on top of the oxide layer formed after etching. The porous oxide layer enables adhesive (or primer) to penetrate the pores readily to form a strong bond.

Application of a primer is another form of surface pretreatment mainly used for materials such as metals and ceramics. Generally, the primer is the final stage of a multistage pretreatment process. Some adherends have ‘difficult to bond’ surfaces (e.g. copper). The primer, which is formulated such that it represents a solvented version of the adhesive, readily wets the adherend. The adhesive, when applied to the primed surface, being chemically compatible, will establish a strong joint on curing.

Essentials for chemical pretreatments

Care must be taken in the preparation of chemical pretreatment solutions, not only because of the handling hazards*, but also because incorrect preparation may lead to bond strengths inferior to those that would have been obtained if there had been no chemical treatment.
Time of application is also critical: too short an application does not sufficiently activate the surfaces, whereas overlong application may build up chemical reaction products which interfere with adhesion.
On completion of a chemical pretreatment, thorough washing of the surfaces with plenty of clean water is standard practice. For the final rinse, the use of deionised (demineralised) water is recommended.

*Safety precautions must be strictly observed where chemical solutions are in use. See Part 5 – Caution.

Metals

The wide range of individual alloys (and the variety of surface structures caused by heat treatments) within each metal group precludes standardising on one pretreatment for each. The following pretreatments are well established but on occasion a different petreatment (not given here) may prove more effective. This can be shown only by comparative trials – using materials from the batch of metal components to be bonded and the type of Araldite adhesive specified for the work.
Additional data on pretreatment of metals is given in ISO 4588 and DEF standard 03-2/2. The recommendations given in this brochure for pretreatment of metals are in compliance with the above.

Aluminium and aluminium alloys

Anodised material Aluminium alloy anodised by the normal chromic acid or sulphuric acid methods and sealed, may be bonded after degreasing and light abrasion. Chromic acid or phosphoric acid anodised material has the optimum surface properties for bonding directly after completion of the anodising process. No pretreatment is needed, but the material must be bonded within a few hours anodising.
Hard anodised aluminium alloy requires stripping either by abrasive blasting or by etching in the sulphuric acid + sodium dichromate (or chromiun trioxide) solution given below. Note: the unstripped metal is unsuitable for bonding.

Non-anodised material Degrease according to Part 1 – Degreasing. Then either abrade according to Part 2 – Abrading.

Or anodise with chromic or phosphoric acid as above

Or etch in a sulphuric acid + sodium dichromate solution made up as follows:

Pour 10-15 litres of clean water into a container with a 50 litre calibration mark. While stirring the water, add 7.5 litres of concentrated sulphuric acid (S.G. 1.84) in a slow steady stream – with continued stirring add 3.75kg of sodium dichromate ($Na_2Cr_2O_7.2H_2O$) – or 2.5kg of chromium trioxide (CrO_3)* – and fill to the 50 litre calibration mark with clean cold water. For best results the aluminium content of the etch should be 1.5-14.0g/l and the copper content 0.06-1.0g/l. (see notes below).**
Immerse the part for 30 minutes at 60-65°C, then wash with clean cold running water, followed by clean hot water, and dry with hot air. The temperature of the hot water and air must not be greater than 65°C.

***This procedure + preliminary degreasing with halocarbon solvent conforms to Process O of DEF Standard 03-2/2. Method O includes a procedure for controlling the composition of etch solution in continual use.**

****European standard EN2334 describes in detail acid chromate pickling procedures and the control of solutions. Similarly DT9915B and DEF STAN 03-2/2 describe control procedures.**

ISO 4588 describes and equally suitable etching process based on a solution of 30 pbw water, 10 pbw concentrated sulphuric acid and 2 pbw sodium dichromate. The parts are immersed for 10 minutes at 65-70°C and then rinsed and dried as above.

Warning Chromium trioxide is an exceptionally powerful oxidising agent. Particular care is essential when handling this chemical. Likewise, particular care is needed when handling concentrated sulphuric acid. – see Part 5 – Caution.

Accomet C*, a solution containing chromium compounds, is an alternative to the chemical pretreatment for aluminium and aluminium alloys. Accomet C in diluted form is applied as a primer coating. Instructions for use are given on page 9 under Primer for Metals.
***British Patent 1,234,181 (Albright & Wilson Ltd).**

Cadmium

Degrease according to Part 1 – Degreasing (page 2). Then either abrade according to Part 2 – Abrading (page 3),
or electro-plate with silver or nickel.

Cast iron

Degrease according to Part 1 – Degreasing (page 2). Then abrade according to Part 2 – Abrading (page 3).

Chromium

Degrease according to Part 1 – Degreasing (page 2). Then either abrade according to Part 2 – Abrading (page 3),
or etch in a solution of:

Concentrated hydrochloric acid (S.G. ca 1.18)	**4.25 litres**
Water	**5 litres**

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

Note Prepare the solution according to the sequence specified on page 14 under Concrete – method 3.

Warning Concentrated hydrochloric acid is highly corrosive. Special care is required. See Part 5 – Caution.

Copper and copper alloys

Degrease according to Part 1-Degreasing (page 2). Then either abrade according to Part 2-Abrading (page 3), **or etch for 30 seconds at room temperature in a solution of:**

Concentrated nitric acid (S.G. ca 1.42)	**5 litres**
Water	**15 litres**

Wash with clean cold running water. Do not allow to dry. Immerse for 2-3 minutes at 95-100°C in a solution of:

Sodium hydroxide	**0.1kg**
Sodium chlorite ($NaC10_2$ technical)	**0.6kg**
Trisodium phosphate (Na_3 P_4O anhydrous)	**0.2kg**
Water	**20 litres**

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.)

The above two-stage chemical pretreatment gives, in general, better bond strengths than the ammonium persulphate pretreatment below. This however offers the advantage of simplicity and the strengths obtained may be adequate for the work in hand.

Etch in a 25% solution of: Ammonium persulphate
Immerse for 30 seconds 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.)
Note Preparation of 25% ammonium persulphate solution: pour about 700ml of deionised water into a container with a 1,000ml calibration mark. Add 250 grammes of ammounium persulphate. Stir until the powder dissolves, then fill to the 1,000ml calibration mark with deionised water.

Warning Concentrated nitric acid is highly corrosive. Special care is required when handling. See Part 5 – Caution.

Araldite Primer DZ 80-1, a hot-setting one-part resin solution, is an alternative to the chemical pretreatments for copper and copper alloys. The use of Primer DZ 80-1 improves bond strength retention during long-term service. Drying and curing schedules for Primer DZ 80-1 are given in the Huntsman Advanced Materials Instruction Sheet No. A.27, available on request.

Galvanised surfaces

Pretreat as for Zinc and Zinc Alloys (page 9).

Gold

Degrease according to Part 1-Degreasing (page 2).

Lead

Degrease according to Part1-Degreasing (page 2). Then either abrade according to Part 2-Abrading (page 3), **or etch in a solution of:**

Concentrated nitric acid (S.G. ca 1.42)	**1 litre**
Water	**9 litres**

Immerse for 10 minutes at 45-55°C, wash with clean running water, followed by clean hot water, and dry with hot air.

Warning Concentrated nitric acid is highly corrosive. Special care is required when handling. See Part 5-Caution.

Magnesium and Magnesium alloys

Degrease according to Part 1-Degreasing (page 2). Then abrade according to Part 2-Abrading (page 3), and apply the adhesive immediately.
The following chemical pretreatment for magnesium alloys produces bond strengths only slightly below those obtainable on the grit-blasted metal. The chemical pretreatment provides an alternative to grit-blasting for metal too thin to withstand the grit-blasting treatment and it is more effective than cleaning by wire brush or abrasive paper.

Degrease according to Part 1-Degreasing (page 2). Then etch in a solution of

Chromium trioxide (CrO_3)	**24 gms**
Water	**123 gms**
Sodium Sulphate (anhydrous)	**1.8 gms**
Calcium Nitrate	**2.1 gms**

Immerse for 3 minutes at room temperature, wash with clean cold running water, followed by clean hot water, dry with hot air and apply the adhesive immediately.

Warning Chromium trioxide is an exceptionally powerful oxidising agent. Particular care is essential when handling this chemical.
See Part 5-Caution.

Nickel and nickel alloys

Degrease according to Part 1-Degreasing (page 2). Then either abrade according to Part 2-Abrading (page 3), **or etch for 5 seconds in: Concentrated nitric acid (S.G. ca 1.42). Wash with clean cold running water, followed by clean hot water, and dry with hot air.**

Warning Concentrated nitric acid is highly corrosive. Special care is required when handling. See Part 5-Caution.

Silver

Degrease according to Part 1-Degreasing (page 2). Then abrade according to Part 2-Abrading (page 3).

Steel-mild

Degrease according to Part 1-Degreasing (page 2). Then either abrade according to Part 2-Abrading (page 3), **or etch in a solution of:**

Orthophosphoric acid (S.G. ca 1.7)	**10 litres**
Industrial methylated spirit	**20 litres**

Immerse for 10 minutes at 60ºC, remove from the solution and then, under clean cold running water, brush off the black deposit with a stiff-bristle nylon brush. Absorb residual water by wiping with a clean cloth soaked with clean industrial methylated spirit or isopropanol. Heat for 1 hour at 120ºC.

Accomet C*, a solution containing chromium compounds, is an alternative to the chemical pretreatment for mild steel. Accomet C in diluted form is applied as a primer coating. Instructions for use are given on page 9 under Primer for Metals.

Warning Orthophosphoric acid is corrosive and requires special care in use. Refer to Part 5 - Caution.

Steel-stainless

Degrease according to Part 1-Degreasing (page 2). Then either abrade according to Part 2-Abrading (page 3), **or etch for 5-10 minutes at 55-65ºC in a solution of:**

Oxalic acid ($(COOH_2)2H_20$)	**5kg**
Concentrated sulphuric acid (S.G. ca 1.83)	**16 litres**
Water	**35 litres**

Note: Prepare solution according to the sequence specified on page 5 under Aluminium and Aluminium Alloys. The oxalic acid will dissolve completely at the immersion temperature.

Prior conditioning (e.g. passivation) of the steel surface may delay the reaction between steel and etch solution. The etch treatment should be timed from the onset of the reaction.

Wash with clean cold running water, then remove the black deposit* by immersing for 5-20 minutes at 60-65ºC in the sulphuric acid + sodium dichromate (or chromium trioxide) etch specified on page 5 under Aluminium and Aluminium Alloys.

Note Trials are recommended with the particular stainless steel to establish the optimum immersion conditions and proportions of the solution constituents. Baths in use for the pretreatment of aluminium alloys must not be used concurrently for the pretreatment of steel.

*Alternatively, remove the black deposit by brushing, under clean *cold* running water, with a stiff-bristle nylon brush, and dry with hot air.
Highest bond strengths, however, are obtained after desmutting by the chemical treatment given above.

Warning Concentrated sulphuric acid and chromic acid are highly corrosive. Special care is needed when handling these chemicals.
See Part 5-Caution

Accomet C*, a solution containing chromium compounds, is an alternative to the chemical pretreatments for stainless steels. Accomet C in diluted form is applied as a primer coating.
Instructions for use are given on page 9 under Primer for Metals.

Titanium and titanium alloys

Degrease according to Part 1-Degreasing (page 2). Then either abrade according to Part 2-Abrading (page 3),

or etch for 1-2 minutes at room temperature in a solution* of:

Concentrated nitric acid (S.G. ca 1.42)	**9.5 litres**
Hydroflouric acid (S.G. ca 1.17)	**0.85 litres**
Water	**40 litres**

Wash with clean cold running water, then immerse for 2-3 minutes at room temperature in a solution* of:

Trisodium phosphate (NA_3 $P0_4$ .12$H_2$0)	**1.75kg**
Potassium flouride (KF.2$H_2$0)	**0.68kg**
Hydroflouric acid (S.G. ca 1.17)	**1 litre**
Water	**40 litres**

Wash with clean cold running water, immerse in clean deionised water† at 55-65°C for 15-20 minutes, remove, wash with clean cold running water (brush off any remaining deposit with a clean stiff-bristle nylon brush) and dry with hot air. The temperature of the hot water and air must not be greater than 65°C.

† Frequent renewing of the deionised water is recommended. Renewing is essential if turbidity appears.

The above chemical pretreatment is used mainly in the bonding of titanium alloy structures for aircraft.
Likewise used for this purpose is:

Etch for 10-20 minutes at room temperature in a solution* of:

Concentrated nitric acid (S.G ca 1.42)	**4.5 litres**
Hydroflouric acid (S.G ca 1.17)	**0.45 litres**
Water	**10 litres**

Wash with clean cold running water (brush off any deposit with a clean stiff-bristle nylon brush), then anodise to give a blue surface film:

Solution: chromium trioxide CrO (60-80 grammes per litre of deionised water). Anode: titanium alloy part to be bonded. Cathode: mild steel (for example). Anode-to-cathode area ratio: 3:1. Potential: increase at 4 volts/minute to 20 volts and maintain for 5-30 minutes, depending on the particular alloy type. Temperature of solution: 38-40°C.

Wash with clean cold running water, followed by clean hot water, and dry with hot air. The temperature of the hot water must not be greater than 65°C.

* Use a polythene or polypropylene container. Mixing procedure: add the acids to the water in a slow and steady stream with continuous stirring.

Warning Chromium trioxide is an exceptionally powerful oxidising agent. Hydroflouric acid and nitric acid are highly corrosive. Particular care is essential when handling these chemicals. See Part 5-Caution.

Tungsten and tungsten carbide

Degrease according to Part 1-Degreasing (page 2). Then either abrade according to Part 2-Abrading (page 3),
or etch in a solution* of:

Caustic soda (sodium hydroxide)	**15 kg**
Water	**35 litres**

Immerse for 10 minutes at 80-90°C, wash with clean cold running water, followed by clean hot water, and dry with hot air.

* Use a stress-relieved mild-steel container.) Aluminium, tin and zinc-coated, galvanised or tinned ware are unsuitable for caustic soda.) Mixing procedure: slowly sprinkle while stirring, flake or pearl caustic soda onto the cold water. Continue stirring until the soda is dissolved.

Zinc and zinc alloys

Degrease according to Part 1 – Degreasing (page 2). Then either abrade according to Part 2 – Abrading (page 3), and apply the adhesive immediately.

Or treat with Bonderite 255 solution according to the supplier's directions:

Degrease, wash with clean cold water, dip (or spray) for 30-45 seconds in Bonderite 255 solution, wash with clean cold water, and dry with hot air.

Primer for metals – Accomet C

The proprietary product Accomet C is highly effective in diluted form as a primer for the bonding of steels and aluminium alloys with Araldite adhesives. The metal surfaces are prepared as follows:

Surface preparation Degrease according to Part 1 – Degreasing (page 2). The best surface condition for wetting out with Accomet C is obtained by a final degreasing with alkaline cleaner or detergent. See Part 1 – Degreasing (page 3, section d).

Application Apply a thin coating of diluted Accomet C solution (by brushing, or by dipping and draining) to both the surfaces to be bonded. Dry in hot air and cure.

Note The optimum weight of coating is dependant on the degree of dilution and should be established by trials. The dilution usually suitable is 1Y part by volume of Accomet C to 4 parts by volume of clean cold water.

Warning: Care is needed to avoid build-up of an over-thick coating – e.g. in recessed areas or complex shapes. This is detrimental to bond strength; moreover it raises a health hazard through dust formation. Accomet C contains hexavalent chromium compounds. Any splashes on the skin should be washed off immediately with water. Dust from dried-off Accomet C must not be inhaled. Refer to Part 5 – Caution.

Curing Curing of the primer depends on the temperature at which the adhesive itself will be cured.

Araldite adhesives cured at temperatures below 100°C

Cure the film of Accomet C primer for at least 20 seconds at 100°C – 250°C. A typical curing schedule is 30 seconds at 200°C. Allow to cool before applying the adhesive.

Araldite adhesives cured at temperatures above 100°C

The film of primer may be cured as above – i.e. prior to application of the adhesive. Alternatively apply the adhesive to the dried film, assemble the joint and cure the adhesive and primer in one operation.

Plastics

Thermosetting plastics: Mouldings, castings, laminates, etc can usually be bonded without difficulty. To ensure good bond strength, all soil and residual release agent must be removed from the joint surfaces before the Araldite adhesive is applied. The surfaces must either be abraded with emery cloth or grit-blasted, or they must 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 adhesive.

Thermoplastics: These are often difficult to bond. Certain types permit only moderately successful bonding, and one and the same material may show considerable variation in properties determining the strength of a bond. Special adhesives have been developed, but they usually prove to be unserviceable when thermoplastics have to be bonded to materials such as wood, metal, etc. Araldite adhesives can be very useful in such cases even though their suitability for bonding thermoplastics is only limited. Pretreated thermoplastics for special applications (e.g. ski 'skins') are easily bonded with Araldite.

The grade of plastic and the manufacturing process used to make the component may influence the effectiveness of the chemical pretreatment. It is advisable to establish by trial whether the pretreatment is improved by adjusting the specified immersion time.

Note: Certain plastics are attacked by one or more of the halocarbon solvents listed in Part 1 – Degreasing. These plastics have suitable degreasing agents specified in the procedures given below. If the procedure does not specify particular degreasing agents, the halocarbon solvents listed in Part 1 are safe to use for the short times normally sufficient to carry out degreasing.

In addition to the normal mechanical and chemical methods of pretreatment, certain plastics can be pretreated using the following methods, all of which cause a change in the surface texture of the adherend. The change is brought about by the interaction of highly energised species with the adherend surface. These pretreatment methods have been applied to metals and in particular composites and plastics.

A low pressure plasma is an excited gas generated by applying a high frequency and high voltage between electrodes in a low pressure chamber. The advantage of this method is that it allows treatment of adherends by different plasmas of argon, ammonia, oxygen or nitrogen making the process suitable for a range of substrate types. Plasmas are generally used to activate the surfaces of adherends.

If instead, a plasma is created in air at atmospheric pressure, the air when ionised appears as a blue/purple glow with faint sparking, and is termed **a corona**. Corona treatments are usually applied for preparing thin polymer films and composite laminates.

The effect of **a flame treatment** is to oxidise the adherend, which produces polar groups creating a surface better suited to wetting by the adhesive. This method of surface pretreatment has been applied successfully to polyethylene/polypropylene. The variables of flame treatment include type of gas, gas/air (oxygen) ration, the rate of flow of mixture, exposure time and distance between flame and adherend.

All these methods have limited stability and vary from hours to weeks according to substrate. Suppliers of specialist equipment are listed on pages 18 and 19. Further information can be found in ISO 13895.

ABS plastics (acrylonitrile-butadiene-styrene)

Degrease according to Part 1 – Degreasing (page 2). Ketone solvents can be used advantageously for degreasing ABS plastics. Then either abrade according to Part 2 – Abrading (page 3),

or etch in a solution of:

Concentrated sulphuric acid (S.G. ca 1.83)	**10 litres**
Sodium dichromate ($Na_2Cr_2O_7.2H_2O$) or	
Potassium dichromate ($K_2Cr_2O_7$)	**140 gms**
Water	**3.3 litres**

Immerse for 15 minutes at room temperature, wash with clean cold running water, followed by clean hot water, and dry with hot air.

Note Prepare the solution according to the sequence specified on page 5 under Aluminium and Aluminium Alloys.

Warning Warning Concentrated sulphuric acid and chromic acid are highly corrosive and require special handling precautions.
See Part 5 – Caution.

Acetal plastics (e.g. ‘Delrin’, ‘Hostaform’)

Degrease according to Part 1 – Degreasing (page 2). Ketone solvents can be used advantageously for degreasing Acetal plastics. Then either abrade according to Part 2 – Abrading (page 3),

or etch in a solution* of:

Concentrated sulphuric acid (S.G. ca 1.83)	**10 litres**
Sodium or potassium dichromate	**140gms**
Water	**3.3 litres**

Immerse for 5 minutes at room temperature, wash with clean cold running water, followed by clean hot water, and dry with hot air.

Note Prepare solution according to the sequence specified on page 5 under Aluminium and Aluminium Alloys.

Warning Warning Concentrated sulphuric acid and chromic acid are highly corrosive and require special handling precautions.
See Part 5 – Caution.

The following* † solution is an alternative to the dichromate solution described above. It is more effective than the dichromate solution but its use necessitates carefully controlled ventilation of the work-area to remove the acrid fumes given off by the hot solution.

Para-Toluenesulphonic acid	**50 gms**
Dioxan	**0.5 litre**
Perchlorethylene	**10 litres**

Immerse for 5 minutes at 120°C, wash with clean cold running water, followed by clean hot water, and dry with hot air.

† British Patent 1,025,675 (Celanese Corporation of America).

* Stresses due to moulding, machining etc, should be relieved by a suitable heat-treatment prior to acid etching. Advice concerning stress relieving should be sought from the manufacturer.

Acetal plastics can also be pretreated using Plasma treatment. The articles should ideally be bonded as soon as possible after Plasma treatment, but the treatment has a long effective shelf life enabling parts to be bonded several days after treatment.

Cellulose plastics

Degrease with a chlorinated solvent or detergent solution – according to Part 1 – Degreasing (page 2). Then abrade according to Part 2 – Abrading (page 3).

Warm preferably for 1 hour at 100ºC and apply the adhesive before the plastic cools completely to room temperature.

Decorative and industrial laminates

Degrease according to Part 1 – Degreasing (page 2). Then abrade according to Part 2 – Abrading (page 3).

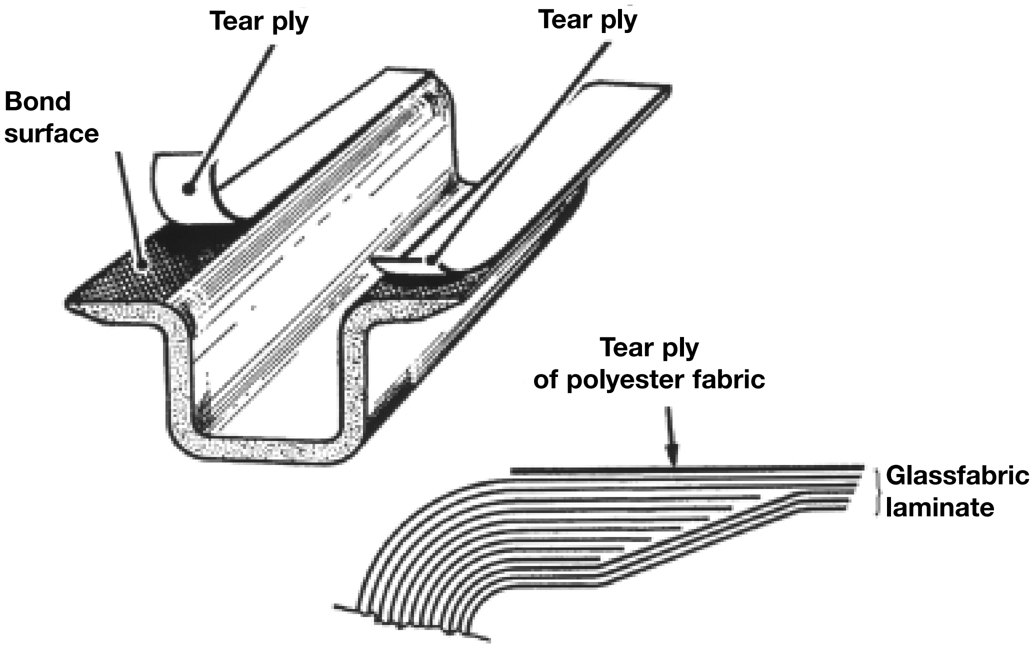
Note: Certain grades of decorative laminates are supplied sanded and need no abrasion.

or Pretreat using Corona/Plasma treatment (see Part 6 – Suppliers).

Glassfabric laminates

Degrease according to Part 1 – Degreasing (page 2). Then abrade according to Part 2 – Abrading (page 3).

Alternatively, design the laminate so that a 'tear ply' of fine closeweave polyester fabric is placed at the surface to be bonded. (The ply becomes part of the laminate on curing.) Just prior to bonding, tear off the ply to expose a fresh clean bond surface on the laminate.



Note Fineweave polyester sailcloths are a suitable tear-ply material.

Polyamides (Nylon)

Degrease according to Part 1 – Degreasing (page 2). Ketone solvents can be used advantageously to degrease polyamide. Then either abrade according to Part 2 – Abrading (page 3),

or Prime with the two-part solution of Redux® 101 primer described on page 13 under Primer for Thermoplastics.

or Pretreat using Corona/Plasma treatment (see Part 6 – Suppliers).

Polyacrylics (e.g. Perspex)

Degrease with alcohol solvent or detergent solution – according to Part 1 - Degreasing (page 2). Then abrade according to Part 2 – Abrading (page 3), and remove dust with alcohol solvent.

For optimal results, it is recommended to stress relieve the plastic by annealing.

Polycarbonate (e.g. Makrolon; Lexan)

Degrease with alcohol solvent (e.g. isopropanol) or detergent solution - according to Part 1 - Degreasing (page 2). Then abrade according to Part 2 - Abrading (page 3),

or Pretreat using Corona or Plasma treatment (see Part 6 – Suppliers).

Polyesters

Thermosetting (unsaturated) polyester resins – see Thermosetting Plastics.
Thermoplastic (polyteraphthlate) polyester mouldings (‘Crastine’, ‘Kelanex’) and films (‘Melinex’, ‘Mylar’):
Degrease according to Part 1 – Degreasing (page 2), using ketone solvents. Then either abrade according to Part 2 – Abrading (page 3),

or Pretreat by Corona or Plasma treatment. (See Part 6 – Suppliers.)

or Prime with the two-part solution described on page 13 under Primer for Thermoplastics,

or Etch in a solution of:

Caustic soda (2kg) in water	**8 litres**

Immerse for 6 minutes at 75-85°C, wash with clean running cold water, followed by clean hot water, and dry with hot air. This treatment will give the best bond strengths

Note: Prepare the solution according to the sequence specified on page 8 under Tungsten and Tungsten Carbide.

Polyolefines (polythene, polypropylene)

Either lightly flame with a waving motion in an oxidising (i.e. blue – not yellow) gas flame until the surface is shiny. Natural gas is particularly suitable, but care must be taken to avoid overheating and melting. (see also page 10).

or Pretreat by Corona or Plasma treatment. See Part 6 – Suppliers.

The following chemical treatment is in general an alternative to flame or corona treatment. Certain grades of polypropylene are, however, not affected by the chemical solution and for these it is not efficaceous as a pretreatment. Preliminary trials are essential when using the chemical solution as a pretreatment for polypropylene.

Degrease according to Part 1 – Degreasing* (page 2). Then etch in a solution of:

Concentrated sulphuric acid (S.G. ca 1.83)	**10 litres**
Sodium dichromate ($Na_2Cr_2H_2O$) or	
Potassium dichromate ($K_2Cr_2O_7$)	**0.3 kg**
Water	**2 litres**

Immerse for 15 minutes at room temperature, wash with clean cold running water, followed by clean hot water, and dry with hot air.

Note Prepare the solution according to the sequence specified on page 5 under Aluminium and Aluminium Alloys.

Warning: Concentrated sulphuric acid awnd chromic acid are highly corrosive and require special handling precautions. See Part 5 – Caution.

Proprietary primers for polypropylene are available which provide an alternative to flame, corona and chemical pretreatments described above. Almost as effective as these pretreatments is degreasing according to Part 1 – Degreasing (page 2), then priming with ISF Polypropylene Primer (according to the supplier’s directions), and allowing to dry in air.

*Certain grades of polythene are attacked by trichloroethylene. It is advisable to use an alternative solvent. See page 2 – when degreasing polythene.

Polyphenylene oxide and similar plastics

Degrease according to Part 1 – Degreasing (page 2), using alcohol solvents. Then either abrade according to Part 2 – Abrading (page 3),
or etch in sulphuric acid/dichromate solution at 70°C for 15 seconds and rinse in clean running water. Dry with hot air.

Polystyrene

Degrease with alcohol solvent or detergent solution according to Part 1 – Degreasing (page 2). Then either abrade according to Part 2 – Abrading (page 3).
The following alternative procedure is more effective than the above but the solution is considerably less convenient to handle.

Or etch in a solution of:

Concentrated sulphuric acid (S.G. ca 1.83)	**10 litres**
Sodium dichromate or potassium dichromate	**0.3 kg**
Water	**2 litres**

Immerse for 15 minutes at 68-72ºC, wash with clean cold running water, followed by clean hot water, and dry with hot air.

Note Prepare the solution according to the sequence specified on page 5 under Aluminium and Aluminium Alloys.

Warning Concentrated sulphuric acid and chromic acid are highly corrosive and require special handling precautions. See Part 5 – Caution.

Polyurethane

Degrease according to Part 1 – Degreasing (page 2). Then abrade according to Part 2 – Abrading (page 3).

or Pretreat with Corona/Plasma treatment (see Part 6 – Suppliers).

PTFE and similar fluorocarbon plastics*

Fluorocarbon plastics such as PTFE (‘Fluon’, ‘Teflon’) cannot normally be bonded in the untreated condition. There are, however, specialised processes (involving flame oxidisation or exposure to dispersions of metallic sodium) for treating the surfaces of fluorocarbon plastics. PTFE already treated by such processes is available from suppliers listed in Part 6.

An etch solution can be made up as follows:

Pour 2 litres tetrahydrofurane into a three-necked flask fitted with a calcium chloride tube and a mixer. In it dissolve 256 grammes naphthalene, then add 46 grammes 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.

PTFE pretreated for bonding with Araldite is available in foil and sheet form from various firms. Names and addresses are available on request.

Suppliers of proprietary etches include:

R. D. Taylor, 240 Edmiston Drive, Ibrox, Glasgow GS1 2YT
(tel. 0141 427 5103).

C.Huth & Söhne, Bietigheim/Württ, Germany. (Teflon-Ätzmittel Typ AM 92).

* The principal flourocarbon plastics are: PTFE (polytetrafluoroethylene), PCTFE (polychlorotrifluoroethylene), FEP (fluorinatedethylene-propylene) and PVF (polyvinylfluoride).

Warning: Metallic sodium is dangerous in contact with air or water, special care is needed when handling this material. See Part 5 – Caution.

PVC

Degrease according to Part 1 – Degreasing (page 2), using Ketone or chlorinated solvents. Then abrade according to Part 2 – Abrading (page 3).

Thermosetting plastics (amino, diallyl phthalate, epoxy, phenolic, unsaturated polyester)

Degrease according to Part 1 – Degreasing (page 2), using ketone solvents. Then abrade according to Part 2 – Abrading (page 3).

Note Laminated thermosetting plastics. See page 11.

Primer for thermoplastics

The primer described below is a two part low-viscosity cold-setting solution. The primer markedly improves the bond strengths of Araldite adhesives to nylon-type plastics (nylon and similar polyamide products). The use of the primer is recommended when bonding nylon-type plastics to themselves – or to other materials such as metal or glass. The primer likewise improves the bond strengths of Araldite adhesives to certain different plastics, such as Perspex, polycarbonate, polystyrene and thermoplastic polyesters.

The primer is also effective as a surface protection solution for these plastics types when there is to be a delay between pretreatment and bonding. The primed surfaces – kept in a dust-free atmosphere (for example, in polythene bags or covered by polythene sheet) in a clean dry place – remain effective for 2-3 months.

The primer is a resin + hardener solution mixture consisting of:

Resin solution	Redux 101	100	pbw
Hardener solution	para-Toluenesulphonic acid	2.9	pbw
	Industrial methylated spirit	25	pbw

The two solutions must be stored separately. Prior to use: mix the resin and hardener solutions together at room temperature, stirring thoroughly. The correct ratio must be ensured.

A 2 litre quantity of mixture has a usable life of ca 6 hours at room temperature.

Apply a thin even coating of the mixture by spatula, brush or roller to the bond surfaces of the thermoplastic only. Diluting the mixture with methylated spirit facilitates spray or dip application.

Dry and partially cure the coated surfaces before applying the Araldite adhesive. Typical times are:
4 hours at 20ºC or 1 hour at 40ºC or 10 mins at 60ºC or 5 mins at 80ºC or 3 mins at 100ºC.

Apply the Araldite adhesive to the primed surfaces, assemble the joint and, while maintaining light contact pressure, cure the primer plus adhesive in one operation.

Miscellaneous materials

Asbestos board

Degrease according to Part 1 – Degreasing (page 2). Allow the board to stand a few minutes to ensure all the degreasing agent evaporates out.

Warning: Loose particles and dust must be removed with extreme care – asbestos is a serious hazard by inhalation of fibres. Refer to local regulations.

Bricks and other fired non-glazed building materials

Degrease according to Part 1 – Degreasing (page 2). Brush with a wire brush and remove dust.

Carbon

Degrease according to Part 1 – Degreasing (page 2). Abrade with fine abrasive cloth or paper, and remove dust.

Ceramics

Degrease according to Part 1 – Degreasing (page 2). Abrade with a slurry of silicon carbide powder and water.

Concrete

Remove heavy grime and laitance by wire brushing. Degrease with detergent solution, according to Part 1 – Degreasing (page 3, section d).

Note: Where concrete is deteriorated and weak, the surface must be removed until sound concrete is exposed.

Even where concrete is sound, it should be pretreated wherever practicable by one of the following methods. Method 1 is more effective than 2, and 2 is more effective than 3.

1. **Remove by mechanical scarification 3mm – or more – of all surfaces to be bonded, then remove dust preferably by vacuum cleaner; or**

2. **Sand-blast about 1.5mm off all surfaces to be bonded, then remove dust preferably by vacuum cleaner; or**

3. **Etch with 12% hydrochloric acid or sulphamic acid solution (1litre per square metre, spread by stiff-bristle brooms) until bubbling subsides (about 15 minutes). Wash with clean water by high-pressure hose until all slush is removed and the surface is neutral to litmus. Final rinsing with 1% ammonia solution followed by clean water is good practice – this ensures thorough neutralisation. Allow the surface to dry thoroughly. Remove dust preferably by vacuum cleaner.**

Note: Preparation of 12% hydrochloric acid solution: pour 2 litres of clean cold water into a clean polythene or earthenware container. While stirring the water, add 1 litre of concentrated hydrochloric acid (S.G. ca 1.18) in a slow steady stream. Preparation of 12% sulphamic acid solution: fill a calibrated clean polythene or earthenware container to the 8litre mark with clean warm water. Slowly sprinkle, with stirring, 1kg of sulphamic acid crystals onto the water. Continue stirring until the acid is completely dissolved. (The crystals do not dissolve in cold water).

> **Warning:** Concentrated hydrochloric acid is a highly corrosive chemical. Particular care is needed when handling the acid.
> See Part 5 – Caution (page 17).

Earthenware

Degrease according to Part 1 – Degreasing (page 2). Then abrade according to Part 2 – Abrading (page 3).

Glass

Degrease according to Part 1 – Degreasing (page 2)*. Then abrade according to Part 2 – Abrading (page 3).
Either warm for ½ hour at 100ºC and apply the adhesive before the glass cools completely to room temperature,

Or, for bonds with improved long-term resistance to water:

Prime the glass surfaces with 5% solution of Silane A-187. Allow to dry in air – or dry with hot air.

Note: Preparation of 5% Silane A-187 solution: pour 85ml of methylated spirit into a container with a 100ml calibration mark. Add 5ml of Silane A-187. Stir thoroughly, then fill to the 100ml calibration mark with water. (This 9: 1 methylated spirit + water mixture imparts 2-3 days storage stability to the solution).

Warning Silane A-187 is toxic: it is harmful if taken internally or absorbed through the skin. Goggles and protective clothing must be worn when Silane A-187 is handled.

* Treatment with the sulphuric acid + sodium dichromate solution specified on page 5 under Aluminium and Aluminium Alloys is a highly effective method for degreasing glass. Immerse for 30 seconds at 60-65c, then wash with clean cold running water, followed by clean hot water, and dry with hot air.

Graphite

Degrease according to Part 1 - Degreasing (page 2). Abrade with fine abrasive paper or cloth, and remove dust.

Jewels

Degrease according to Part 1 – Degreasing (page 2).

Leather

Degrease according to Part 1 – Degreasing (page 2). Roughen with abrasive paper and remove loose particles.

Plaster

Allow the surface to dry thoroughly. Smooth with fine abrasive paper or cloth, and remove dust.

Rubber

Degrease with trichlorotrifluoroethane or detergent solution – according to Part 1 – Degreasing (page 2). Then etch with modified bleach solution, with concentrated sulphuric acid depending on the type of rubber.

Note: Degreasing with clean cold *trichloroethylene* is effective as a pretreatment for certain rubber types – see the comparison table on page 16. Particular care must be taken when handling trichloroethylene and trichlorotrifluoroethane. See Part 5 – Caution (page 17). Owing to the increased toxic hazard raised, the manual use of trichloroethylene is in general not an approved practice.

Modified bleach solution

Household bleach (standard type)	300ml
Concentrated hydrochloric acid (S.G. ca 1.18)	50ml
Water	10 litres

Immerse for 1-3 minutes at room temperature, wash with cold clean water, followed by clean hot water, and dry with hot air.

Note: Concentrated hydrochloric acid is a highly corrosive chemical. Particular care is needed when handling the acid. See Part 5 – Caution (page 17).

Prepare the modified bleach solution by pouring the clean water into a clean container made of plastic, glass or similar inert ware. While stirring the water, add the concentrated hydrochloric acid in a slow steady stream. Then add the household bleach, stirring it thoroughly into the diluted acid. Never pour the household bleach into the acid (or the other way round) without adding the water first.

Fresh solution should be made up each day. The solution gives off chlorine: good ventilation is essential.

Sulphuric acid etch

Concentrated sulphuric acid (S.G. ca 1.83)

Immerse for 2-10 minutes at room temperature, wash with clean cold running ware, followed by clean hot water, and dry with hot air.

Note: Immersion time depends on the rubber type and grade. For optimum surface properties, immersion should continue only until flexing the rubber produces fine crazing over the joint surfaces. Particular care is needed when handling concentrated sulphuric acid. See Part 5 – Caution (page 17).

Vertical surfaces may be treated with a paste prepared by adding sufficient barytes powder to the acid to prevent it from flowing.

The modified bleach solution is however considerably less hazardous to handle than concentrated sulphuric acid.

Relative effectiveness of pretreatment liquids

	Trichloroethylene solvent	Modified bleach solution	Sulpuric acid
		Effectiveness of solvent or solution	
Butyl	**R**	**R**	-
Ethylene propylenediene monomer (EPDMR)	**R**	E	E
Natural	E	**R**	-
Neoprene	-	-	**R**
Nitrile	**R**	**R***	-
Styrene-butadiene	-	-	E

Key: **R = Recommended** E = Effective - = Not Effective

Joints pretreated with a liquid rated as *Recommended* for the particular rubber type give the highest bond strengths. The use of a liquid rated as *Effective* gives substantially improved bond strengths; they are however, less than the strengths obtained after pretreatment with a *Recommended* liquid.

* *Nitrile rubber joints* Highest bond strengths are obtained after pretreatmnent with modified bleach and bonding with Araldite AY 103 + Hardener HY 991. Nitrile rubber joints bonded with different Araldite adhesives give lower bond strengths. The best bond strengths given by these alternative adhesives are obtained after pretreatment with trichloroethylene.

Rubber-silicone

Silicone rubbers, by their chemical nature, are unsuitable for bonding with Araldite adhesives.

Stonework

All the surfaces to dry thoroughly. Brush with a wire brush and remove dust.

Wood

Ensure the wood is dry. Plane – or abrade with glass paper and remove dust.

Note The moisture content of the wood should not exceed 16%. Some hardwoods can be difficult to bond.

Part 4 – Essentials for maximum bond strength

Araldite adhesives are simple to use, but to ensure successful bonding the directions given in the instructions supplied with the adhesive must be strictly observed.

In particular:

1. Resin and hardener must be correctly proportioned and thoroughly mixed together.
2. Joint surfaces must be degreased and, when necessary, pretreated.
3. Curing temperature and curing time must be correct.
4. Jigs or other fixtures must be used to prevent the bond surfaces from moving relative to one another during the curing process.
5. Though only light pressure is needed, it should be applied as evenly as possible over the whole bond area. Excessive pressure leaves the joint starved of adhesive.

General

This manual lists many chemicals that require cautionary labelling under local legislation in many countries, e.g. UK legislation – Chemicals (Hazard Information on Packages) Regulations 1993. It is important to read, and fully understand, suppliers' technical and safety data sheets, making sure all precautions are in place before commencing work.

Halocarbon solvents

As halocarbon solvents remove the natural grease from the skin, contact with the hands should be avoided as far as possible. Suitable gloves – e.g. nitrile, should be worn.

The place of work should be well ventilated with an efficient extraction system. Information on safe working concentrations of vapour is given in the current edition of *Occupational Exposure Limits – Guidance EH40**.
The vapours from halocarbon solvents have an anaesthetic effect and consequently cause drowsiness if inhaled in quantity. Any person so affected should lie down in the open air and be kept quiet and warm (given no exercise) while a doctor is called.

*Guidance Note EH40 is available from HSE Books, PO Box 199, Sudbury, Suffolk CO10 6FS. Outside the UK, advice should be sought from the Health and Safety Authority in the user's country.

Where halocarbon vapour is present, open flames and smoking must be prohibited – they cause the vapour to form poisonous gases.

Acids, caustic soda, etc.

Concentrated acids, oxidising agents e.g. dichromates, and hot caustic soda solution are highly corrosive chemicals. Spillages and splashes can cause severe damage to eyes and skin, and attack ordinary clothing. Fine-particle mists resulting from the stirring or agitation of the solutions can present a severe respiratory hazard. Operators must wear personal protection e.g. goggles, protective clothing, respirators.

Important Never pour water into acids. Always pour the acid in a slow steady stream into the water, with continuous stirring. Bear in mind that the handling hazard is intensified when the acid is hot.

Chromium Compounds

These materials have health hazards ranging from harmful to those that are highly toxic and carcinogenic. Ensure that the latest safety data is available for the particular compound chosen.

Sodium

Pieces of sodium react violently and may explode on contact with water, emitting flammable hydrogen gas. Sodium burns spontaneously in air and vapours ignite at room temperature. It also reacts explosively with many aqueous solutions and some organic solvents – mainly chlorinated hydrocarbons – and reacts vigorously with many others on heating. Sodium reacts incandescently with some (mostly halogenated) compounds. Mixtures of sodium and metal halides are sensitive to mechanical shock. Sodium is highly toxic and corrosive, causing severe thermal and caustic burns to tissues in the presence of moisture.

Araldite products

Araldite resins and hardeners are generally quite harmless to handle provided that certain precautions normally taken when handling chemicals are observed. The uncured materials must not, for instance, be allowed to come in contact with foodstuffs or food utensils, and measures should be taken to prevent the uncured materials from coming in contact with the skin, since people with particularly sensitive skin may be affected. The wearing of impervious rubber or plastic gloves will normally be necessary; likewise the use of eye protection. The skin should be thoroughly cleansed at the end of each working period by washing with soap and warm water. The use of solvents is to be avoided. Disposable paper towels – not cloth towels – should be used to dry the skin. Adequate ventilation of the working area is recommended. These precautions are described in greater detail in the Huntsman Advanced Materials Manual *Hygienic Precautions for Handling Plastics Products of Huntsman Advanced Materials* and in the Huntsman Advanced Materials Product Safety Data Sheets for the individual products. These publications are available on request and should be referred to for fuller information.

Selected suppliers of pretreatment materials and adhesives processing equipment

Abrasives and blasting equipment

Matrasur département Vocublast, Z.A. Les Glaises, 36 avenue du 1er Mai, 91124 Palaiseau Cedex, France (tel. (1) 69 19 17 25)

Wheelabrator Sisson Lehmann, Z.I. de Mahon, 24 rue Camille Didier, B.P. 39, 08001 Charleville Mezieres Cedex, France (tel. (?) 24 33 63 00)

RAGA GmbH, Kriegsbergstr. 12, D-71336 Waiblingen, Germany (tel. 07151-98901-0)

Werkzeug-und Industrieausrüstungs GmbH, Niederstr. 24, D-40789 Mannheim, Germany (tel. 02173-52029)

Abrasive Developments Limited, Norman House, Henley-in-Arden, Solihull, West Midlands B95 5AH, UK (tel. 01564-792231)

Guyson International Limited, PO Box 18, West Yorkshire LS21 1RD, UK (tel. 01756 69911)

UCF, Woodson House, Ajax Avenue, Slough SL1 4DJ, UK (tel. 01753 526511)

Solvents and chemicals

Accomet C

Albright & Wilson Ltd, Surface Technologies European Headquarters, PO Box 3, 210-222 Hagley Road West, Oldbury, Warley, West Midlands B68 ONN, UK (tel. 0121-429-4942)

Bonderite 255

Brent Europe, Adrox Pyrene Limited, Ridgeway, Iver, Buckinghamshire (tel. 01753 630200)

ISF Polypropylene Primer

International Shoe Findings Ltd, Thurmaston Boulevard, Leicester LE4 7HS, UK (tel. 01162 742222)

Redux 101

Hexcel Composites, Duxford, Cambridge CB2 4QA (tel. 01223 833141)

Silane A-187

Albright and Wilson Limited, 210-222 Hagley Road West, Warley, West Midlands B68 0NN (tel. 0121 429 4942)

Trichloroethylene

Lambert & Riviere, 17 ave Louison Bobet, Val de Fontenay, 94132 Fontenay Sous Bois Cedex, France (tel. (1) 49 74 80 80)

S.P.C.I. (Sté de Produits Chimiques Industriels), 43 rue Cristino Garcia, B.P. 43, 93212 La Plaine Saint Denis, France (tel. (1) 49 33 31 31)

Biesterfeld, Gertrudenstraße 14, D-20095 Hamburg, Germany (tel. 040-30080)

Brenntag AG & Co, Humboldring 15, D-45472 Mülheim a.d. Ruhr, Germany (tel. 0208-4940)

Deutsche Solvay-Werke GmbH, Langhansstr 6, D-42697 Solingen, Germany (tel. 0212-704-0)

ICI Chemicals & Polymers Ltd, Solvents Sales Department, PO Box 14, Runcorn, Cheshire WA7 4QG, UK (tel. 01928 511190)

Samuel Banner & Co Ltd, 59-61 Sandhills Lane, Liverpool L5 9XL, UK (tel. 0151 944 7000)

Plasma and Corona Pretreatment equipment

Sherman Treaters N.A. Inc, 964, Westport Crescent, Unit 7, Mississauga, Ontario, L5T 1GI, Canada (tel. (416) 670 9117)

RR Print A/S, Rodovrevej 245, DK-2610 Rodovre, Denmark (tel. 010 45 31 41 36 66)

Cogeplast, 39 rue Rouvrel, 80110 Mailly Raineval, France (tel. (3) 22 09 82 43)

Polymix Z.I., 6 rue de l’Industrie, 68126 Bemlihr Sare, France (tel. (3) 89 20 13 80)

Perkin Elmer (Division Instruments), 1 rue Franklin, B.P. 304, 78054 Saint Quentin en Yvelynes Cedex, France (tel. (1) 30 85 63 63)

Marcatec International, 10 rue du Noyer, F-67203 Oberschaeffolsheim, France (tel. (3) 8878 5880)

Soreprind, 2 rue Condorcet 4200 Saint Etienne, France (tel. (4) 77 74 20 01)

Arcotec Oberflächentechnik GmbH, D-7251 Wimsheim, Mönsheimer Straße 20, Postfach 1101, Germany (tel. 07044 5952/4077)

BMP Plasmatechnologie GmbH, Dr. Guido Bell, Weissenfelder Straße 4, D-85551, Kirchheim, Germany (tel. 089-9039903)

Buck Technologien, Plasma Electronic, Buck Plasma Electronic GmbH, Fabrikstr. 17, D-70794 Filderstadt, Germany (tel. 0711-77903-0)

Haug GmbH & Co. KG, Friedrich-List-Strasse 18, 7022 Leinfelden-Echterdingen 2, Germany (tel. 0711 94980)

Plasma-electronic, Fabrikstraße 17, D-7024 Filderstadt 4 (Bonlanden), Germany (tel. 0711-7775517)

Plasmatechnologie Blersch GmbH, Eichenweg 13, D-70771 Leinfelden-Echterdingen, Germany (tel. 0711-791106)

Technics Plasma GmbH, Dieselstr. 22a, D-85551 Kirchheim (bei München) Germany (tel. 089-905030)

Tigres Dr. Gerstenberg GmbH i.G., Zum Fürstentor 11, D-21079 Hamburg, Germant (tel. 040-79012300)

Plasonic Oberflächentechnik GmbH, Carl Zeiss Straße 9, D-70839 Gerlingen, Germany (tel. 07156-23711)

Webber Brennertechnik, Landmannweg 18, 4600 Dortmund – Oespel 1, Germany (tel. 0231 652 438)

The Aerogen Company Limited, Newman Lane, Alton, Hampshire GU34 2QW, UK (tel. 01420 83744)

Combustion Engineering Consultancy, Weydale Rise, Alton, Hampshire GU34 2TY, UK

Sherman Treaters Ltd, Dormer Road, Thame Industrial Estate, Thame, Oxon OX9 3UW, UK (tel. 01844 213686)

Acovent Srl, Via Cavour, 81-83, 20030 Senago, Milan, Italy (tel. (2) 998 61 9192)

F.D.M., S.R.L., Corco Sempione 80/a, I-20015 Parabiago, Milano, Italy (tel. 331 554 826)

Logopak 8.V, Prof. Lorentzweg 6 B, NL-5140 Waalwijk (tel. 4160 44144)

Tantec Inc, 630 Estes Avenue, Schaumburg, IL 60193, USA (tel. (708) 529 5506)

Flame pretreatment equipment

Sherman Treaters N.A. Inc., 964, Westport Crescent, Unit 7, Mississauga, Ontario, L5T 1GI, Canada (tel. (416) 670 9117)

RR Print A/S, Rodovrevej 245, DK-2610 Rodovre, Denmark (tel. 31 41 36 66)

Boussey Control, 10 rue d’Abrantés, 21500 Montbard, France (tel. (3) 80 89 1 10)

Donze, La Flie, B.P. 51, 54460 Liverdun, France (tel. (3) 83 24 49 95)

Soreprind, 2 rue Condorcet 4200 Saint Etienne, France (tel. 77 74 20 01)

Webber Brennertechnik, Landmannweg 18, 4600 Dortmund – Oespel 1, Germany (tel. 0231 652 438)

The Aerogen Company Limited, Newman Lane, Alton, Hampshire GU34 2QW, UK (tel. 01420 83744)

Sherman Treaters Ltd, Dormer Road, Thame Industrial Estate, Thame, Oxon, OX9 3UW, UK (tel. 01844 213686)

Flynn Controls B.V., Industrial Control Systems, Zonnebaan 27-29, 3606 CH Maarssen, Holland (tel. 30 41 4199)

Acovent Srl, Via Cavour, 81-83, 20030 Senago, Milan, Italy (tel. (2) 998 61 9192)

Flame Treaters esse CI s.r.l, Via Flaminia 386 I-05035 Narni TR, Italy (tel. (0744) 72 67 41)

Matsuzaka Co.Ltd, S.Otsuka, Nishimatsu Bldg, 20-10 Toranomon, 1 Chome Minato-Ku, Tokyo 105 Japan (tel. 011/81 33 502 1251)

Flynn Burner Corporation, 425 Fifth Avenue, New Rochelle, NY 10802, USA (tel. (914) 636 1320)

Part 7 – Index to materials

The individual materials covered by this instruction manual are mainly those in common use in industry. Engineers contemplating the bonding of particular materials not listed below are invited to submit enquiries concerning appropriate pretreatments to our technical staff.

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