ADHESIVE AND SOLVENT BONDING - MAINTENANCE PRACTICES

1. General

A. This section describes the application of adhesives and solvent bonding.

B. A protective coating is applied to particular areas like exterior placards to protect the placard from hydraulic fluid and weather elements.

2. Safety

A. Cleaning and bonding operations should be performed in well ventilated areas away from sparks or flames.

B. Cleaning solvents should be dispensed from approved containers. Solvent wetted cheesecloth should be disposed of in special safety containers provided solely for this purpose.

C. Rubber gloves should be worn when practical, and hands should be washed prior to eating or smoking after handling solvents and adhesives.

3. Clear Polyurethane Topcoat

A. Mix the clear polyurethane C63C with the AA-92-C-39 catalyst according to manufacturer's directions. Apply the clear polyurethane coating in three uniform, 50 percent overlay spray coats to an approximate thickness of 2 1/2 to 3 mils dry film thickness. Air dry 4 to 6 hours or force dry at approximately 135°F for 1 hour.

NOTE: All equipment should be cleaned immediately after use with T732A thinner.

4. Material Classification

A. Type I, Epoxy Base Adhesive.

(1) Used for bonding metal to metal, fiberglass, wood and thermoplastics.

B. Type II, Oil Resistant, Synthetic Rubber Base Adhesive.

(1) Used for bonding fabric, leather, rubber, insulation batting, metals and ABS thermoplastics.

C. Type III, Fuel Resistant, Synthetic Rubber Base Adhesive.

(1) Used for bonding cork, leather and rubber gaskets to metals where there may be some exposure to fuel; also for rubber, wood, glass, vinyls and some plastics.

D. Type IV, Synthetic Resin Base Adhesives.

(1) Used for bonding vinyl materials to themselves or metals, glass, plastics and wood.

E. Type V, Silicone Rubber Base Adhesives.

(1) Used for bonding metals, plastics, glass, ceramic and rubber insulation.

F. Type VI, Solvent Cementing.

(1) Used for cementing thermoplastics to themselves. Solvents should be either C.P., U.S.P. or Reagent Grade. Heat and pressure may be used as an alternate method.

G. Type VII, Cyanoacrylate Base Adhesive.

(1) Quick setting adhesive used for plastics, metals and rubber (not waterproof).

H. Type VIII, Pressure Sensitive Adhesive.

(1) Used for quick mounting of small parts of metal, plastic, glass, wood or fabric.

I. Type IX, Polyurethane Base Adhesive.

(1) Used to bond plastics to themselves or other plastics.

J. Type X, Acrylic Plastic Base Adhesive.

(1) Used for bonding acrylic plastics to themselves, other plastics or metals.

5. Material

Table 201. Adhesives

NAME	NUMBER	MANUFACTURER	USE
Type/Class IA	EA-9304.1 EA-9346.5	The Dexter Corporation Aerospace Material Division Ft. Lauderdale, FL	Adhesive

Type/Class IB	EA-9309.3NA EA-9314NA EA-9330.3 EA-9339	The Dexter Corporation Aerospace Material Division	Adhesive
	EPK-9340	The Dexter Corp. Engineering Adhesives Division Seabrook, NH	Adhesive
Type/Class IC	EA-9394 EA-9396	The Dexter Corporation Aerospace Material Division	Adhesive
Type/Class ID	A-1186-B	SIA Adhesives Inc. 123 West Bartges St. Akron, OH 44311	Adhesive
Type/Class IE	Fastweld 10	Ciba-Geigy Corp. Furane Aerospace Products Los Angeles, CA	Adhesive
	608 Epoxy-Patch	The Dexter Corp. Engineering Adhesives Division	Adhesive
	Polystrate 5-Minute Epoxy	ITW Devcon 30 Endicott St. Danvers, MA 01923	Adhesive
Type/Class IF	EA-960F	The Dexter Corporation Aerospace Material Division	Adhesive
	Aluminum Putty F	ITW Devcon	Adhesive
Type/Class IG	16307	Dayton-Granger Inc. 3299 SW 9th Ave. P.O. Box 350550 Ft. Lauderdale, FL 33335	`Adhesive
	KE4238/HD3475	The Dexter Corp. Electronic Materials Divsion Olean, NY	Adhesive
Type/Class IH	15348	Dayton-Granger Inc.	Adhesive
Type/Class IIA	SC-1589	H. B. Fuller Company 1200 Willow Lake Blvd. P.O. Box 64683 St. Paul, MN 55164	Adhesive
	Vangrip 14-30	Mid-West Industrial Chemical Co. St. Louis, MO	Adhesive
	1300-L	3M Adhesives, Coatings & Sealers Division St. Paul, MN	Adhesive
Type/Class IIB	30-NF2000-NF/Spray	3M Co.	Adhesive
Type/Class IIIA	Scotch-Grip 847	3M Co.	Adhesive
Type/Class IIIB	EC-776	3M Co.	Adhesive
	EC-776SR	3M Co.	Adhesive

	CS-3600	Flamemaster Corp. Chem Seal Division Sun Valley, CA	Adhesive
Type IV	EC2262	3M Co.	Adhesive
	4693	3M Co.	Adhesive
Type/Class VA	RTV102 RTV103 RTV108	General Electric Company Silicone Products Dept. Mechanicville Rd. Waterford, NY 12188	Adhesive
	RTV732 RTV734	Dow Corning Corp.	Adhesive
Type/Class VB	RTV106	General Electric Company	Adhesive
Type/Class VC	RTV157 RTV159	General Electric Company	Adhesive
Type/Class VD	93-076 RTV	Dow Corning Corp.	Adhesive
	PSA529/ SRC18	General Electric Company	Adhesive
Type/Class VF	Silastic 730	Dow Corning Corp.	Adhesive
Type/Class VIIA	Loctite 49550	Loctite Corp. Newington, CT 06111	Adhesive
Type/Class VIIB	Blak Max 38050 38061	Loctite Corp.	Adhesive
Type VIII	950 Transfer Tape 4930 VHB Tape 4945 VHB Tape Scotch-Mount 4962	3M Co. Industrial Tape and Specialties Division St. Paul, MN	Adhesive
	FasTape 1191 UHA Transfer Tape FasTape 3099 UHA Transfer Tape	Avery Dennison Specialty Tape Division Painesville, OH	Adhesive
Type/Class IXA	Thixon 405	Morton Intl. Inc. Specialty Chemicals Group/Adhesives West Alexandria, OH	Adhesive
Type/Class IXB	HE17017	Hartel Enterprises, Inc.	Adhesive
	Uralane 8089A/B Uralane 5774A/B	Ciba-Geigy Corp. Reliable Division Fountain Valley, CA 92708	Adhesive
Type X	32555 707	Loctite Corp.	Adhesive
	PS-18 PS-30	Caseway Industrial Products 6624 Prospect St. P.O. Box 249 Caseville, MI 48725	Adhesive
Type XI	Hot Melt Adhesive 6363	Bostik Inc. Middleton, MA	Adhesive
Type/Class XIIA	Duco Cement	ITW Devcon	Adhesive

Type/Class XIIB	Velcro #40	Velcro USA Inc. Manchester, NH	Adhesive

Table 202. Solvent Cements

NAME	NUMBER	MANUFACTURER	USE
Class VI Methyl n-Propyl Ketone MIBK Acetone Cyclohexanone Tetrahydrofuran Methylene Dichloride Ethylene Chloride		(All solvents should be either C.P., U.S.P. or Reagent Grade)	Cleaning
	EC4801	3M Co.	

6. Requirements for Bonding

A. Surfaces to be bonded must be clean and dry, free from dust, lint, grease, oil, condensation, other moisture and all other contaminating substances.

B. Jelled or over aged adhesives should not be used until they are tested.

C. Bonds should be free of wrinkles and entrapped air bubbles. They should not be loose at the edges or exhibit poor adhesion.

D. Containers for adhesives should be kept tightly closed when the adhesives are not being used, unless otherwise specified.

E. Adhesives should not be applied when the temperature of either the adhesive or the surfaces to be bonded is below 65°F.

F. Two component adhesives require weighing and mixing unless pre-weighed kits are used. Weighing equipment should be kept clean and personnel doing the weighing should use good personal hygiene.

G. Metals should be chemically cleaned. In general, cleaning of metal surfaces for bonding consists of removing oils and greases by solvent or soap solutions. This is followed by mechanical abrading of the surface. Loose abraded particles should be removed before bonding.

H. In general, plastics, rubber, leather, cork, wood, etc., should be cleaned of oil and grease by use of solvent. Bonding of plastics and rubber will be improved by abrading the surface after degreasing. Loose abraded particles should be removed before bonding.

NOTE: All surfaces prepared for adhesive bonding should be free of grease, fingerprints, paint, heat scale, corrosion, smut, powder, etc.; slight water stains are permissible providing the surface passes the following:

(1) Examine metal surfaces while they are still wet from the rinsing operations for continuity of water film. Formation of water droplets or discontinuity of the water film (water break) indicates the presence of oily or greasy residues and parts should be reprocessed.

(2) If doubt exists to quality of rinse, the following test may be applied to parts while they are still wet from the rinsing operation. Select a representative area of the bonding surface and test this area with pH indicating paper. A pH of less than 5.0 or greater than 9.5 requires rerinsing and retesting of surface.

7. Manual Cleaning and Deoxidizing of Aluminum Alloys

A. Procedure.

NOTE: Exercise care to prevent trapping solutions at the edge of joints.

(1) Remove oil, grease, ink, etc. by solvent cleaning.

(2) Mask off dissimilar metals or surface not to be deoxidized.

(3) Spray, brush or swab alkaline cleaner (Turco 4215) on surface. Keep area to be cleaned wet for at least 5 minutes.

(4) Spray rinse thoroughly with room temperature water for a minimum of 3 minutes.

(5) With an acid brush, apply paste cleaner 0.06 inch to 0.12 inch thick on surface to be bonded. Allow the paste cleaner to remain on the surface for 45 to 60 minutes.

(a) Paste cleaner (all measure by weight).

1 Sulfuric Acid (Concentrated, Technical Grade): 38 percent, +2 or -2 percent; Sodium Dichromate Dihydrate: 7 percent, +1 or -1 percent; Cab-O-Sil: 7 percent, +1 or -2 percent.

2 Balance: distilled water.

(6) Remove the paste with dry cheesecloth. Wash the area with a clean cheesecloth saturated with high purity water. Parts should be water-break free. If not, repeat procedure above beginning with Step 3. Dry the area for 15 minutes minimum with heat lamps before bonding.

NOTE: Parts processed should be handled so as to prevent recontamination by dirt, grease, fingerprints, etc. Personnel handling prepared surfaces for adhesive bonding should wear clean, white, low-lint gloves. Change gloves frequently to avoid contamination. Gloves may be contaminated easily by contact of working surface with body oils or hair. These soils must not be transferred to bonding surfaces. Prepared surfaces of items that will require transportation or short time storage should be wrapped with clean kraft paper.

8. Liquid Solvent Cleaning

WARNING: Solvents should be considered flammable and should not be exposed to flames or sparks under any circumstances. Fresh air masks and/or adequate ventilation is required for all closed areas.

A. Requirements.

(1) Plastic or rubber materials should not be immersion cleaned or vapor degreased.

(2) Solvents should never be poured or sprayed on surface to be cleaned.

(3) It is essential that clean cloths and clean solvents are used during the final cleaning operation.

(4) Bonding or subsequent priming operations should be accomplished as soon as possible after cleaning and drying of surfaces.

(5) Solvent cleaned surfaces should be dry and free of all visible soils. Iridescent surfaces are evidence of improper cleaning.

B. Procedures.

(1) Liquid solvent cleaning should generally be used when it is not practical to clean parts of assemblies by vapor degreasing or immersion in chemical cleaners. However, some finishing codes require solvent cleaning. One or more steps may be eliminated if the surfaces to be cleaned are not soiled enough to warrant the inclusion of all steps.

(2) Wipe off excess oil, grease or dirt from surface.

(3) Apply solvent to a clean, oil-free cloth, preferably by pouring solvent on the cloth from a safety can or other approved container. The cloth should be well saturated but not to the point where it is dripping.

(4) Wipe the surface with the moistened cloth as required to dissolve or loosen soil. Work on a small enough area so that the surface being cleaned remains wet.

(5) With a clean dry cloth, immediately wipe the surface while the solvent is still wet. Do not allow the surface to evaporate dry.

(6) Repeat Steps (3) through (5) until there is no discoloration on the drying cloth.

C. Additions or Exceptions.

(1) Metals.

(a) Prior to bonding or priming, lightly abrade surface with ScotchBrite brand pads, Clean N&#65533; Finish material, Type A fine or aluminum oxide 320 grit sandpaper. Remove loose abraded particles and follow by solvent cleaning.

CAUTION: Abrasives containing silicone carbide are not suitable for this purpose and should not be used.

(b) Metal surfaces should be cleaned with a solvent chosen from reference Table 203.

Table 203. Solvent Metal Cleaners

METAL	SOLVENT
All	Methyl n-Propyl Ketone MIL-PRF-680 Solvent, Dry Cleaning, Type III TT-I-735 Isopropyl Alcohol

Table 204. Solvent Cleaners for Plastic Materials

PLASTIC TYPE	SOLVENT
ABS (Acrylonitrite-Butadiene-Styrene)	TT-I-735 Isopropyl Alcohol
Cellulose Acetate	MIL-PRF-680 Solvent, Dry Cleaning, Type III
CAB (Cellulose- Acetate-Butyrate)	
PPO (Polyphenylene Oxide)	
Polystyrenes	
Polyurethanes	
Silicones	
Vinyls	
Acrylics	TT-I-735 Isopropyl Alcohol
Polycarbonates	
Epoxies	
Melamines	
Nylons	
Phenolics	
Polyesters	Methyl-n-Propyl Ketone
Polyethylenes	Detergent, Liquid Dishwashing
Polypropylenes	
Polyimides	TT-I-735 Isopropyl Alcohol
Fluoroplastics (TFE, FEP, KEL-F)	MIL-PRF-680 Solvent, dry cleaning, Type III
	Methyl n-Propyl Ketone TT- I-735 Isopropyl Alcohol

(2) Plastic or rubber.

(a) Removal of heavy soil from surfaces may be accomplished by washing the surface with a mild water and liquid dishwashing detergent solution prior to solvent cleaning.

CAUTION: Abrasives containing silicone carbide are not suitable for this purpose and should not be used.

(b) Prior to bonding, lightly abrade surface with aluminum oxide 180 grit sandpaper. Remove loose abraded particles and follow by solvent cleaning.

(c) Surfaces should be cleaned with a solvent chosen from Table 204 for plastic or Table 205 for rubber materials.

Table 205. Solvent Cleaners for Rubber Materials

RUBBER TYPE	SOLVENT
Buna S	TT-I-735 Isopropyl Alcohol
Buna N	
Neoprene	
Thiokol	
Butyl	
Natural	
Silicones	TT-I-735 Isopropyl Alcohol
Ethylene Propylene	

NOTE 1:
When cleaning rubber, use fluid sparingly and dry dampened area thoroughly.

9. Adhesive Mixing, Application and Curing

A. Type I Epoxy.

(1) These adhesives are two component materials and require weighing to obtain the proper amount of each component. Thorough mixing of the weighed components is required for the adhesive to perform properly. Do not mix large batches of the adhesives at one time as this reduces the pot life of the adhesive. Four hundred grams of the adhesive will generally give a pot life of 30 minutes. Small batches and shallow containers will lengthen pot life. Apply a coat of adhesive 0.020 to 0.030 inch (0.5 to 0.8 mm) thick to the surface to be bonded. Press bonded surfaces together to extrude excess adhesive and air so that the resultant bondline is 0.005 inch to 0.010 inch (0.13 mm to 0.25 mm) thick. Pressure may be applied by clamps or weights until cured. Cure for 24 hours at 77°F (25°C) or 2 hours at 180°F (82°C).

(a) Type IA (EA9309.3NA). Combine 100 parts by weight of component A with 23 parts by weight of component B. Mix thoroughly. Weight and mix per instructions on containers.

(b) Type IB (EA907). Combine 100 parts by weight of component A with 80 parts by weight of component B. Mix thoroughly and follow instructions on container. (Devcon F). Combine 1 part by weight Devcon F hardener with 9 parts by weight of Devcon F. Mix thoroughly to a lump free mixture. Devcon F will cure in 2 hours at 77°F (25°C). Both of these materials are primarily fillers for hole repair. Apply and shape to the desired thickness or contour, allow to cure, then sand to the desired shape or size.

(c) Type IC (EA9394NA and 380/6). These high temperature adhesives are mixed by combining 100 parts by weight of base material to 33 parts of hardener. Observe mixing instructions on containers.

(d) Type ID (A1186-B). Combine 1 part by weight of A1186-B catalyst A with 8 parts by weight of A1186-B, then mix thoroughly. The pot life of the mixed material is approximately 8 hours at 77°F (25°C). Apply a coat of adhesive on the surfaces to be bonded and allow them to air dry until the solvent odor is gone (approximately 3 to 4 minutes at 77°F (25°C)). Press the faying surfaces firmly together, preferably using a hard rubber or plastic roller and allow them to remain together for 16 hours at 77°F (25°C) before handling. Cure for 24 hours at 77°F (25°C) before applying stress to the bond. Maximum strength develops in 5 days at 77°F (25°C). Pressure may be applied by clamps or weights during part or all of the 5-day period as desired.

(e) Type IE (EC2216). Combine 100 parts by weight of component B with 140 parts by weight of component A. Mix until the components blend to a uniform medium gray color.

(f) Type IF (number 10). Combine equal weights or volume of both components. Mix together until material is one color. Apply to joint. Work life is only 5 minutes and material sets in 10 minutes. Apply pressure to the joint or component being bonded. Adhesive should carry a load within 1 hour.

B. Type II, III and IV Synthetic Rubber and Resin Adhesives.

NOTE: These adhesives are single component solvent blends of rubber or resin. They have high initial tack and will bond a wide variety of different materials.

(1) Apply a coat of adhesive on the surfaces to be bonded and allow them to air dry until most of the solvent has evaporated and the adhesive exhibits an aggressive tack. This condition can be determined by touching the adhesive lightly using the back of the knuckle instead of the fingertips in order to minimize contamination. When the adhesive is quite tacky but no longer transfers to the back of the knuckle, the surfaces are ready for bonding. This normally requires from 3 minutes to 30 minutes depending on film thickness, nature of the surfaces, temperature and humidity.

(a) Very porous surfaces may require two coats. If two coats are applied, let the first coat dry completely from 30 minutes to 60 minutes before applying the second coat and testing for tack as described above.

(b) When bonding two nonporous surfaces, the coat of adhesive to both surfaces may be allowed to dry completely and then one surface reactivated with a very light coat of adhesive and tested for tack as described above. This latter procedure will reduce the amount of solvent trapped in the bond and is especially useful in the case of bonding nonporous surfaces since trapped solvents can greatly prolong the time required for the bond to reach full strength.

(c) Press the faying surfaces firmly together, preferably using a hard rubber or plastic roller and apply any needed clamps or weight. Cure for at least 24 hours at 77°F (25°C) before applying any stress to the bond.

(2) Type II.

(a) EC880. Bond according to procedures in step (1).

(b) EC847. Bond according to procedures in step (1).

(c) EC1300L. Bond according to procedures in step (1).

(d) 5452 Contact Adhesive. Bond according to procedures in step (1).

(e) 5431 Tuf-Grip Cement. Bond according to procedures in step (1).

(f) 1636. Bond according to procedures in step (1).

(3) Type III.

(a) EC847. Bond according to procedures in step (1).

(4) Type IV.

(a) Type IV (EC2262). Bond according to procedures in step (1).

C. Type V Silicone Rubber Adhesives.

NOTE: These adhesives are one part silicone rubber material which will bond a wide variety of different materials. Cure of these adhesives is initiated by moisture in the air. Nonporous surfaces being bonded with these adhesives will cure very slowly or not at all on wide bond lines.

(1) Apply a coat of adhesive to the surfaces to be bonded and press them firmly together within 10 minutes. Apply pressure by clamps or weights for at least 24 hours at 77°F (25°C) before handling.

(2) Type VA (RTV157). Bond according to procedures in step (1).

(3) Type VB (RTV159). Bond according to procedures in step (1).

(4) Type VC.

(a) RTV732. Bond according to procedures in step (1).

(b) RTV734. Bond according to procedures in step (1).

(c) RTV738. Bond according to procedures in step (1).

(d) RTV102. Bond according to procedures in step (1).

(e) RTV103. Bond according to procedures in step (1).

(f) RTV108. Bond according to procedures in step (1).

(g) RTV109. Bond according to procedures in step (1).

(h) RTV162. Bond according to procedures in step (1).

(5) Type VD (RTV106). Bond according to procedures in step (1).

(6) Type VE (RTV94-034). Bond according to procedures in step (1).

D. Type VI Solvent Bonding.

(1) This type bonding depends on the solvent softening the plastic surfaces to be bonded. The softened surfaces are pressed together and held until the solvent evaporates and the plastic hardens. The appropriate solvent may be applied to plastic surfaces by brushing, spraying, dipping or by use of a felt pad.

(2) Allow the solvent to remain on the plastic until both surfaces soften then immediately join the surfaces while wet.

(3) Apply clamps, weight or a holding fixture to keep the bonding surfaces in solid contact until the bond is firmly set. Allow the bond to set for 24 hours at 77°F (25°C) before applying any stress to the bond.

E. Type VII Cyanoacrylate.

(1) Apply adhesive to surface to be bonded. Do not apply excess adhesive. Mating parts should fit well so the bond line will be 0.005 inch (0.13 mm) or as specified on label. Apply clamping pressure.

F. Type VIII Pressure Sensitive.

(1) Clean surfaces to be bonded. Apply adhesive to bond surface and assemble with pressure. Adhesive gains strength with time under pressure although most parts may be handled within 5 to 10 minutes after application of pressure.

G. Type IX Polyurethane.

(1) This adhesive is a tough, flexible material which bonds a variety of plastic materials as well as aluminum. The adhesive offers excellent low temperature performance plus good peel. Weigh and mix adhesive in accordance with

directions on label. Apply adhesive to area to be bonded. Clamp parts together so the resultant bond line will be within 0.005 inch to 0.020 inch (0.13 mm to 0.51 mm) and there is no entrapped air. Parts may be lightly handled after 6 hours but 24 hours of cure is preferred.

H. Type X Acrylic.

(1) PS-18.

(a) The mixing of PS-18 cement is based on 4 fluid ounces (118 ml) of cement. The 4 fluid ounces have a useful life of 30 minutes. Mix at a temperature of 65°F to 80°F (18°C to 27°C). Batches larger than 4 fluid ounces (118 ml) should not be mixed at one time. Do not mix more cement than can be used in 30 minutes. Unused cement should be discarded after 30 minutes.

(b) Add one capsule (2.4 g) of catalyst mixture (component B) to 4 fluid ounces (118 ml) of base cement (component A). Dissolve by stirring. The base cement with catalyst added may be stored in a refrigerator at 40°F (4°C) or below for 24 hours.

WARNING: Do not mix catalyst (Component B) directly with promoter (Component C). A violent reaction will take place when these two materials are directly mixed together. If promoter (Component C) is accidentally spilled on skin, remove immediately by washing with soap and water.

(c) Just before using the catalyzed cement, add 5 ml of promoter (component C) to the mixture. Stir thoroughly. Do not add component C to more cement than can be used in 30 minutes.

(d) Surfaces of acrylic to be bonded should have these areas sanded and cleaned with aliphatic naphtha Type II (TT-N-95) before application of cement. Apply cement to bond area in sufficient quantity so the bond line, after pressure application, will be 0.005 inches to 0.015 inch (0.13 mm to 0.38 mm). Apply clamps or pressure by other means and hold for at least 3 hours at 75°F (24°C). After this time, parts may be lightly handled. Allow 24 hours at 75°F (24°C) for more complete cure.