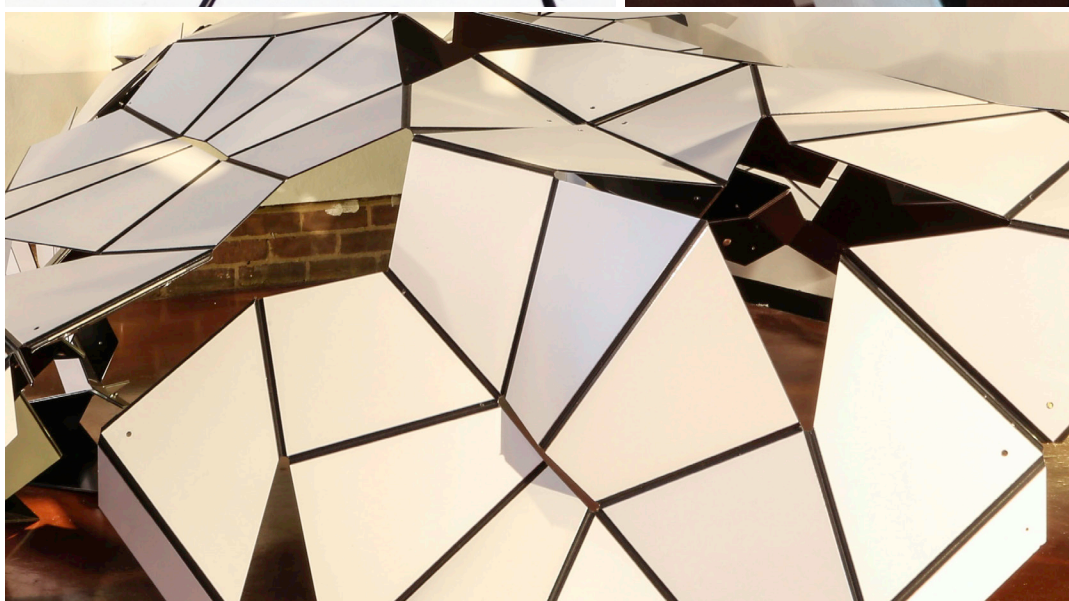
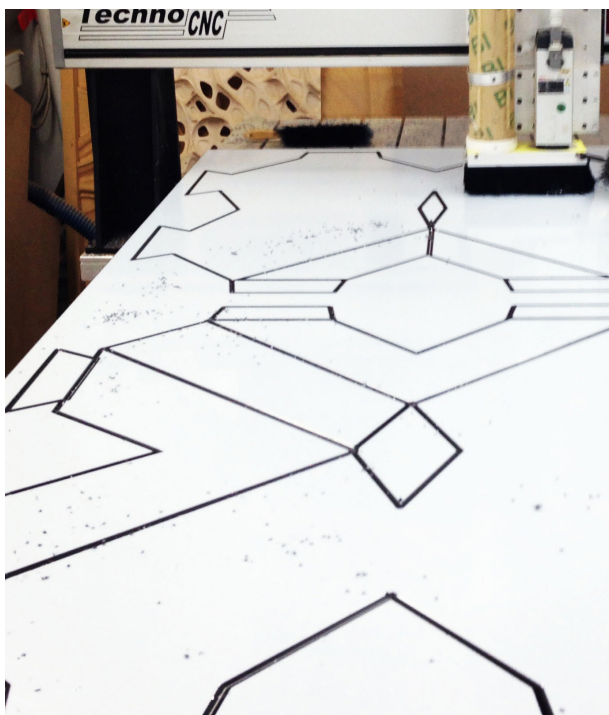




The Aluminum Composite Material (ACM) Collection

DIBOND® DIBOND® BUTLERFINISH®
E-PANEL™ EPL-5™

FABRICATION GUIDE



3A Composites USA

3ACOMPOSITESUSA.COM / 800.626.3365

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INTRODUCTION

Thank you for choosing a 3A Composites product for your graphic display applications.

This Fabrication Guide was created to incorporate the most common fabrication methods that are used with 3A Composites' line of graphics display products. Not all fabrication methods are compatible with each product, but this format was kept for consistency purposes. **The term "the substrate" is used throughout this guide and is meant to apply to all members of the substrate family unless noted otherwise.** Those fabrication methods that do not apply to a certain product are stated with a short explanation and a recommendation for an alternative product that fits that application method.

This manual also contains **Appendix I** which provides a **Material Safety Data Sheet** section. **Appendix II** includes an adhesives, fastening and storage guidelines section. Any unique product information will be contained in Appendix II. See Table of Contents. An Appendix III section lists products that can be used in conjunction with 3A Composites products. 3A Composites is not responsible for the performance of any of these products when used independently or with any 3A Composites product.

The date of the last revision is shown on the bottom right hand corner of each page. Please make sure you have the most current version by going to 3acompositesUSA.com and selecting the fabrication manual from the downloads section.

If you have any further questions about our product or about how to use this manual, please feel free to contact us at 1-800-626-3365.

PLEASE NOTE:

TRIALING IS RECOMMENDED TO ENSURE SUITABILITY FOR THE PROPOSED APPLICATION AND FABRICATION BEFORE FULL-SCALE COMMERCIALIZATION.

INTRODUCTION TO DIBOND

DIBOND material is an affordable, aluminum composite material (ACM) made of two lightweight sheets of .012" aluminum with a solid thermoplastic core. The material is intended for such applications as point of purchase displays, exhibits and kiosks, framing, archival framing, interior signage and exterior signage as well as structural signage. Additionally, **DIBOND's** unique properties lend itself to very unique OEM industrial applications, such as engine covers, housings, etc.

The sheets are pre-painted with a polyester paint finish applied to both sides of the sheet. **DIBOND** material is available in 2mm, 3mm and 4mm thicknesses in 4' x 8', 4' x 10', and 5' x 10' sheets. The substrate is available in: White Matte, Jet Black Black Matte, Dark Bronze, Aluminum Metallic, Red High Gloss & Matte, Yellow High Gloss & Matte, British Green High Gloss & Matte, Ultra Marine Blue High Gloss & Matte, BUTLERFINISH, BUTLERFINISH Copper and BUTLERFINISH Steel. Consult the DIBOND website for the most current products at 3acompositesUSA.com.

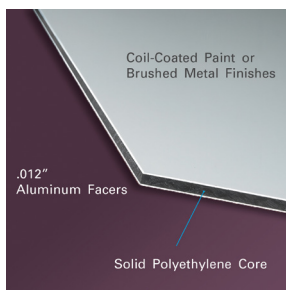
DIBOND material is a UL (Underwriters Laboratories Inc.®) recognized component for electrical signage (UL 94V-0). All thicknesses of **DIBOND** material meet the criteria for ASTM E-84, and are Class 1 or Class A materials.

DIBOND material can substitute for:

- .032", .040", .050", .063", .080", .090" & .125" aluminum sheet
- MDO Board/Laminated Boards/Corrugated ACM Boards
- Thick Gauge Plastics
- Wood/Plywood Products
- Expanded PVC

The **DIBOND** Collection consists of:

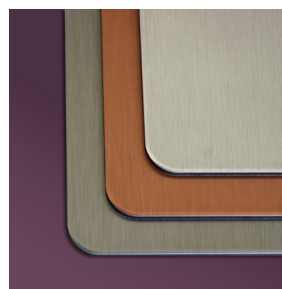
- DIBOND
- DIBOND Colors
- DIBOND BUTLERFINISH® Metals
- **NEW!** DIBOND Mirrors



DIBOND



DIBOND Colors



DIBOND BUTLERFINISH
Brushed Metals



DIBOND Mirrors

Alternative aluminum composite materials available:

- E-PANEL™
- EPL-5™

WHY CHOOSE DIBOND?

The Aluminum Composite Material (ACM) Family

DIBOND has been the industry's leading ACM for more than 20 years. It is comprised of two pre-painted sheets of .012" aluminum with a solid polyethylene core.

- Flattest panel on the market
- Superior surface protects expensive digital and screen-printed graphics
- Provides excellent durability in outdoor applications
- Won't bow or oil can
- Approximately one half the weight of a solid aluminum sheet
- Can be routed and returned to add dimension or roll-formed to deliver sweeping curves
- Available in a wide range of colors and finishes

E-PANEL™ is comprised of two pre-painted sheets of .008" aluminum with a solid polyethylene core, and manufactured in China.

- Recommended for flat panel applications only

EPL-5™ is comprised of two pre-painted sheets of .005" aluminum with a solid polyethylene core, and manufactured in China.

- Recommended for flat panel applications only

Applications

- Wall-mounted Signs
- Billboards
- Post & Panel Signage
- Scoreboards
- Column/Pole Covers
- Photomounting
- Fascia/Sign Bands
- Routed Sign Faces
- Point of Purchase Displays
- Cart/Kiosk Mfg.
- Transportation Applications
- Screen Printing
- Backing for Channel Letters
- Interior Signage
- Digital & Electrostatic Printing
- Awnings
- Custom Exhibit Booths
- Murals
- Custom Architectural Signage
- Workzone, Traffic, Highway Signage
- Illuminated & Non-illuminated Signage

APPLICATION GUIDE

	POP Displays	Exhibits & Fixtures	Framing	Interior Signage	Exterior Signage	Structural Signage	Interior Design	Packaging	Poster Glazing	Mechanical Assembly
\$ FOME-COR FOUNDATION Acid-Free	○	○	■ ⁰	○						
FOME-COR	○	○	■	○						
FOME-COR with ENCORE Technology	○	○	■	○						
FOME-COR SIRIUS with HP ColorPRO Technology	○	○		○						
FOME-COR SINGLESTEP Heat-Activated	○	○	■	○						
FOME-COR CANVAS	○	○	■	●			●			
FOME-COR JETMOUNT	○	○	■	○						
FOME-COR QUICKSTIK Self-Adhesive	○	○	■	○						
DISPA	○	○	■	○			○	○		
DISPA SIRIUS with HP ColorPRO Technology	○	○		○				○		
DISPA OUTDOOR	○	○			○			○		
SINTRA CONSTRUCT		●	■			●				■
SINTRA VERS	●	●	■	●	●					
SINTRA	●	●	■	●	●		●			
SINTRA ECLIPSE	●	●	■	●	●		●			
GATORBLANKS	●	●		●	●					
GATORPLAST	●	●	■	●	●					
GATORFOAM	●	●	■	●	● ¹					
GATORFOAM PRO	●	●	■	●	● ¹					
GATORFOAM EXTERIOR	●	●			● ¹					
GATORFOAM SELF-ADHESIVE	●	●	■	●						
LUMEX G	●	●	■	●				●	●	●
E-PANEL / EPL-5	■	■	■	■	■					
\$\$\$ DIBOND	■	■	■	■	■	■ ²	■			■

Trialing is recommended to ensure suitability for the proposed application before full-scale commercialization.

- Short term application
- Medium term application
- Long term application
- 0 Archival mounting applications
- 1 Black GATORFOAM is not recommended for outdoor usage
- 2 Applications such as workzone signage, canopies, pylons, and column covers

FABRICATION GUIDE

	Mounting	Repositioning Vinyl	Digital Printing	Screen Printing	Painting	Knife Cutting	Saw Cutting	Routing	Die Cutting / Punching	Embossing	Forming Curves	Creasing
\$ FOME-COR FOUNDATION Acid-Free	◇ ⁰					◇			◇	◇		
FOME-COR	◇		◇	◇	◇ ³	◇			◇	◇		
FOME-COR with ENCORE Technology	◇		◇	◇	◇ ³	◇			◇			
FOME-COR SIRIUS with HP ColorPRO Technology			◇			◇			◇	◇		
FOME-COR SINGLESTEP Heat-Activated	◇					◇			◇	◇		
FOME-COR CANVAS			◇	◇	◇	◇			◇	◇		
FOME-COR JETMOUNT	◇		◇	◇	◇ ³	◇	◇	◇	◇	◇		
FOME-COR QUICKSTIK Self-Adhesive	◇					◇			◇	◇		
DISPA	◇		◇	◇	◇	◇		◇	◇		◇	◇
DISPA SIRIUS with HP ColorPRO Technology			◇			◇		◇	◇		◇	◇
DISPA OUTDOOR			◇	◇	◇	◇		◇	◇		◇	◇
SINTRA CONSTRUCT	◇ ¹	◇			◇	◇ ⁴	◇	◇	◇ ⁵		◇	
SINTRA VERS	◇ ¹	◇	◇	◇	◇	◇ ⁴	◇	◇	◇ ⁵		◇	
SINTRA	◇ ¹	◇	◇	◇	◇	◇ ⁴	◇	◇	◇ ⁵		◇	
SINTRA ECLIPSE	◇ ¹	◇	◇	◇	◇	◇ ⁴	◇	◇	◇ ⁵		◇	
GATORBLANKS	◇				◇	◇	◇	◇				
GATORPLAST	◇	◇	◇	◇	◇ ³	◇	◇	◇	◇ ⁵			
GATORFOAM	◇		◇	◇ ²	◇ ³		◇	◇				
GATORFOAM PRO	◇		◇	◇ ²	◇ ³		◇	◇				
GATORFOAM EXTERIOR	◇		◇	◇ ²	◇ ³		◇	◇				
GATORFOAM SELF-ADHESIVE	◇	◇					◇	◇				
LUMEX G	◇	◇	◇	◇	◇		◇	◇	◇		◇	
E-PANEL / EPL-5	◇ ¹	◇	◇	◇	◇		◇	◇	◇ ⁶			
DIBOND	◇ ¹	◇	◇	◇	◇		◇	◇	◇ ⁶		◇	

Trialing is recommended to ensure suitability for the proposed fabrication before full-scale commercialization.

- 0 Archival conservation mounting
- 1 Cold mounting techniques only
- 2 Face priming will provide better results
- 3 Do not expose polystyrene foam to solvent-based paints
- 4 1-3mm may be cut with a knife or blade
- 5 May be die cut in gauges up to 5mm or 3/16"
- 6 Punch press die set is required

SECTION I: MOUNTING

General Notes

Mounting, laminating and bonding are terms that are often times interchanged. For this document mounting is defined as the attachment of the graphic to the substrate. Lamination is the application of a covering (film or liquid) over the mounted item to either protect the graphic or provide a certain appearance i.e. matte or glossy finish. Bonding also conveys affixing one thing to another. This can involve a graphic to a substrate or one substrate to another. This document uses the term “mounting” to convey affixing as opposed to bonding. A paper, foil, plastic or fabric graphic can be mounted to the substrate.

With regard to adhesive, mounting consideration should follow the adhesive manufacturer’s instructions. In general, determine the minimum amount of adhesive lay down to attain the desired adhesion level. It is advisable to leave the boards for a period of time to setup. Consult the adhesive manufacturer’s instructions to see what specific times are recommended. Please refer to Appendix I for additional adhesive information.

Mounting Methods

There are a variety of methods (adhesive, pressure, etc.) for mounting a graphic to a substrate. For this document, mounting will be broken into two groupings; hot or cold mounting, with discussion on the various methods of applying pressure.

- i. Hot mounting provides a heat source to activate the adhesive. Typically, this is accomplished with a heat source associated with either a vacuum press or a roller press.
- ii. Cold mounting typically utilizes a spray or pressure-sensitive film or coating in combination with a roller press.

Printed papers, foils, and fabrics can all be mounted to the substrate provided that the proper types of adhesives are selected. Mounting can be accomplished on most standard equipment capable of applying adhesive and laminating sheets or roll stock to rigid boards.

Surface Preparation

Surface should be cleaned and free of any surface contaminants (i.e. oils, dust particles, etc.) prior to commencing.

The substrate should be cleaned with isopropyl alcohol, using a non-colored cloth for best results. It is important not to use thinners or soaps as they may leave a film residue which can affect adhesion. Additionally, cleaners containing silicone can interfere with adhesion and are not recommended.

Other Considerations

Care should be taken when using laminate films on only one side of the mounted graphic. Moisture pickup will be sealed on one side while the other side is not protected from moisture pickup. Bowing may occur because of moisture imbalance.

Additionally, care should be taken when mounting only one side with spray adhesives. As the mount cures out, tensile forces within the adhesive may cause the substrate to bow. It may be necessary to apply a counter-mount of comparable strength on the backside.

Finally, one must use the minimum amount of tension when mounting with film or pressure sensitive adhesives as too much tension will cause the substrate to bow; too little will cause the graphic to wrinkle.

SECTION I: MOUNTING

Hot Mounting

The substrate is not recommended for this fabrication method.

Cold Mounting - General Notes

Getting Good Adhesion

- a. To cold mount pressure-sensitive adhesives, you need sufficient pressure. You also must make sure that proper spacers are used. Because effective mounting depends on equal force exerted across the entire width of the substrate being mounted, the top roll must move down evenly left and right. Even contact between the top and the bottom mounting rolls is essential.
- b. Adequate pressure helps squeeze out air from between the adhesive, the substrate and the print.
- c. The mount obtained after 3 hours will generally allow for processing. Maximum mount is usually obtained within 24 hours after mounting.
- d. To test adhesion, flex the finished mount. It should not come loose in the center.
- e. Moisture can become trapped between layers of porous material (such as paper) and cause blisters. The level of moisture in the atmosphere should be reduced before press work. Prints may even have to be pre-dried.
- f. When tacking prints to the substrate, some shops will hang a number of tacked pieces in an upside-down position until they are ready to pass them through. As a precaution, it is advisable not to hold them any longer than 10 minutes or the prints may absorb moisture, change in dimension and cause bubbles and wrinkles.
- g. Please contact the film manufacturer for recommendations concerning the use of their respective laminating material in conjunction with the substrate as film choice is the most important consideration.
- h. It is advisable to use a film with a high "green tack" strength. When using pressure sensitive films, the substrate should be at room temperature to achieve optimal results.

Demounting Bad Mounts

- a. Pressure-sensitive adhesives may be demounted if done within 5 minutes after mounting. The print will probably be ruined, but the substrate may be reused.
- b. Beyond 5 minutes, the adhesive has set and other methods will have to be used, such as a hot air gun or a hair dryer to peel off the laminate. The remaining adhesive may be taken off with isopropyl alcohol or mineral spirits.

Avoiding Wrinkles & Surface Blemishes

- a. Wrinkles can be caused by misalignment of adhesive roll, too much pressure, or unparallel rolls.
- b. Small bumps, particularly visible with Cibachrome or glossy prints, are caused by trapped dirt or hardened adhesive. Good housekeeping and an ionizing static eliminator on the press are important to minimize dirt pick-up. During mounting, the back of the print should be checked and wiped down before it is processed. If bumps are caused by hardened adhesive (cut open to check), use a fresh roll or sheet of transfer adhesive. To prevent strikethrough, one might also consider using a print made with thicker paper (.007+).

SECTION I: MOUNTING

Cold Mounting General Notes (cont'd.)

Clear Overlays

- a. Clear high-gloss overlays enhance color and protect against fading indoors and outdoors. To avoid blistering, do not use overlays, clear coatings, or sprays which contain solvents.

Cold Mounting Procedures

By Hand Using Transfer Adhesive

- a. Take a sheet of transfer adhesive (both sides covered by release paper) and fold back release paper on one side approximately 1/2" from one edge.
- b. Tack on edge of print to exposed adhesive.
- c. Lift the print slightly, remove the rest of the release paper and use a roller or squeegee to smooth the print onto the adhesive. The back of the print is now coated with an adhesive which is protected by release paper.
- d. Before mounting to the substrate, remove excess air between print and adhesive. This is done by turning the print over so that the release paper is up and smoothing out from the center with a squeegee.
- e. Now peel off approximately 1/2"–1" of release paper from upper edge and fold back.
- f. Tack on to the substrate, lining up edges.
- g. Using a hand roller or squeegee, closely follow the removal of the liner to eliminate bubbles caused by air entrapment. Work with a small surface at a time (approximately 12"). Continue this step until the mounting is complete.

By Hand or Press Using Spray Adhesive

- a. Spray adhesive on the back of the piece to be mounted. Spray 6"–8" away from the surface. A double coat is best, with the second coat applied in a cross direction to the first coat. For mounting most art materials, adhesive need only be applied to one surface, preferably the print. Avoid using excessive bonding adhesive.
- b. Before mounting, allow adhesive to dry to the touch; the adhesive must be aggressively tacky. If there are blisters due to trapped solvent, allow slightly longer than 4 minutes of drying time.
- c. Carefully position piece on the substrate and smooth out if possible to eliminate any wrinkles and trapped solvent.
- d. If using a press, simply turn on the press to complete the mount.
- e. If mounting is done by hand, place a clean sheet of the substrate over the laminated piece and weigh down for 15 minutes to obtain the maximum bond. Depending upon the type of adhesive, allow 24 hours for maximum cure out before exposing the laminate to sudden temperature or humidity changes.

By Roller Laminator With Adhesive-backed Graphic

- a. Adjust rollers to the thickness of the substrate to provide adequate pressure for mounting.
- b. Peel off a 1/2"–1" section of release paper from the upper edge of the preprinted adhesive backed paper.
- c. Tack on to the substrate, lining up edges.
- d. Feed tacked edge into nip of rollers keeping printed piece bent away from the substrate.
- e. As it passes through the rollers, strip away the release paper. (Make sure there are no wrinkles or trapped dirt.)

SECTION I: MOUNTING

Cold Mounting Procedures (cont'd.)

Cold Mounting Non-Porous Graphics

- a. For non-porous material such as PVC, other plastics or metal, the following types of contact adhesive with solvent may be used.
 - i. Neoprene, nitrile, polyurethane or other synthetic rubber types
 - ii. Adhesive must be applied to both faces. Parallel beads of adhesive are often preferred because it allows evaporation of solvent providing faster cure.
 - iii. For mounting the substrate to flexible PVC sheets, only plasticizer-resistant types of adhesives should be used.

Cold Mounting Porous Graphics

- a. For porous materials such as paper, textiles, fabrics or wood, the following adhesives may be used.
 - i. Contact adhesive with solvent: Same systems as for non-porous materials.
 - ii. Construction mastic, structural silicone adhesives.
- b. Considerations such as expected temperature ranges (expansion/contraction), porous material, and size of substrate should be taken into careful consideration when deciding on a method of attachment.

Cold Mounting with Pressure Sensitive Tapes

- a. Pressure sensitive tapes can be used for:
 - i. Less demanding applications that are stress-free.
 - ii. Adhering parts during installation work.
 - iii. Holding parts while the primary adhesive is curing.
- b. Trial Pressure sensitive tapes prior to use.

SECTION I: MOUNTING

TROUBLESHOOTING WHEN USING COLD MOUNTING PRESSES		
Poor adhesion or bubbles:	<ul style="list-style-type: none"> a. Insufficient pressure b. Stripping back more than 1" of release paper while tacking on print traps air c. Premature contact between print and adhesive traps air d. The print contains moisture 	<ul style="list-style-type: none"> a. Increase mounting roll pressure if running without spacer shims. If using spacer shims, use next smaller size b. Never strip back more than 1" of release paper c. As it is fed through rolls, the print should be tilted or bent away from adhesive until it enters the nip d. Pre-dry print and/or keep humidity at a low level
Curl (bowing):	<ul style="list-style-type: none"> a. Too much web tension 	<ul style="list-style-type: none"> a. Reduce unwind brake pressure
Wrinkles:	<ul style="list-style-type: none"> a. Misalignment of adhesive roll, causing web tension b. Top and bottom mounting rolls are not parallel c. Too much pressure d. Substrate material thickness relative to shim thickness is too great (should be no more than 1/32"). 	<ul style="list-style-type: none"> a. Shift the material roll on the bar to release tension b. Stripping back more than 1" of release paper while tacking on print traps air c. Reduce roll pressure d. If correctly sized spacer shims are not available, zero the nip

SECTION II: REPOSITIONING VINYL

General Notes

Major market brands of vinyl films work well with the substrate. These vinyl films are, for the most part, flexible PVC films and are produced in various thicknesses, color shades, and gloss levels. They can also be un-pigmented to act as a UV inhibitor. These films have a layer of adhesive and a siliconized sheet of cover paper. These films generally have excellent adhesion to the substrate. Final selection of a particular vinyl should be made after consultation with the manufacturer to ensure conformity for its application.

For thinner gauge substrates (1mm, 2mm) the technique of “counter-balancing” should be considered. A vinyl sheet may be required on the back side of a vinyl covered substrate to prevent the possibility of bowing.

As a rule, take caution to avoid too much tension when applying vinyl, as excessive tension may lead to bowing of the substrate.

Surface Preparation

- a. Surface should be cleaned and free of any surface contaminants (i.e. oils, dust particles, etc.) prior to commencing
- b. The substrate should be cleaned with 70% isopropyl alcohol, using a non-colored cloth for best results. It is important not to use thinners or soaps as they may leave a film residue which can affect adhesion. Additionally, cleaners containing silicone can interfere with adhesion and are not recommended.

Repositioning the Vinyl

- a. Identify any misaligned or improperly adhered vinyl graphic
- b. Using a sharp edge or razor blade held at a 45-degree angle to the substrate, begin to lift the vinyl, taking care to not scratch the substrate surface.
- c. After lifting enough of the vinyl surface in order to grab between the fingers, continue to peel back the graphic byhand, proceed with a proper speed so as to not tear or damage the vinyl graphic.
- d. Once completely removed, lay the vinyl graphic face-down smoothly on transfer paper.
- e. Reposition the vinyl graphic face-up in the proper location on the substrate and gently rub the transfer paper to re-adhere the vinyl graphic.
- f. Remove the transfer paper and gently press out any wrinkles or bubbles within the vinyl graphic by hand.

SECTION III: DIRECT DIGITAL PRINTING

General Notes

Large format digital printing on flatbed printers has excellent application for the substrate. Although the substrate is available in a wide range of colors that all demonstrate excellent ink adhesion, the predominant substrate color is white when direct digital printing. However, colored variations of the substrate may provide vibrant color contrasts depending upon the availability of a white print head on the printer.

Surface Preparation

- a. Surface should be cleaned and free of any surface contaminants (i.e. oils, dust particles, etc.) prior to commencing
- b. The substrate should be cleaned with 70% isopropyl alcohol, using a non-colored cloth for best results. It is important not to use thinners or soaps as they may leave a film residue which can affect adhesion. Additionally, cleaners containing silicone can interfere with adhesion and are not recommended.

Suitable Inks

- a. Actual ink type depends upon the printer make and model. Consult the printer owner's manual for recommendations. Trialing for ink compatibility is always recommended.
- b. The substrate readily accepts all types of inks including:
 - i. Aqueous
 - ii. Solvent-based
 - iii. UV-curable

SECTION IV: DIRECT SCREEN PRINTING

General Notes

Large format screen printing has excellent application for the substrate. The substrate is available in a wide range of colors that all demonstrate excellent ink adhesion.

Surface Preparation

- a. Surface should be cleaned and free of any surface contaminants (i.e. oils, dust particles, etc.) prior to commencing.
- b. The substrate should be cleaned with 70% isopropyl alcohol, using a non-colored cloth for best results. It is important not to use thinners or soaps as they may leave a film residue which can affect adhesion. Additionally, cleaners containing silicone can interfere with adhesion and are not recommended.

Suitable Inks

- a. When screen printing with the substrate, the following inks may be suitable:
 - i. Solvent-based
 - ii. Vinyl/Acrylic
 - iii. UV-cured
- b. Screen Printing inks should be tested in a manner which duplicates your printing process before initiating production. It is advised that you contact the equipment and ink supplier to provide you with specific recommendations to achieve maximum results. It is strongly recommended to consult the appropriate ink manufacturer regarding any required ink additives such as catalyst for proper adhesion and exterior use.

Ink Curing

- a. The ink, once applied, must be given proper time and treatment to completely adhere and cure.
- b. The substrate can must be cured by air drying, jet drying under 40 seconds at a maximum temperature of 175°F or UV cured. Temperature dwell times in excess of these limits may cause warping or distortion of the panel.

SECTION V: PAINTING

General Notes

Painting is a suitable fabrication option for the substrate, whether for artistic expression or more commercial applications. On some projects that involve the substrate, a small quantity of “custom color” may be required that is often not practical to obtain from the factory and post painting is a viable option.

Surface Preparation

- a. Surface should be cleaned and free of any surface contaminants (i.e. oils, dust particles, etc.) prior to commencing.
- b. The substrate should be cleaned with 70% isopropyl alcohol, using a non-colored cloth for best results. It is important not to use thinners or soaps as they may leave a film residue which can affect adhesion. Additionally, cleaners containing silicone can interfere with adhesion and are not recommended.

Suitable Paints

- a. The substrate readily accepts the following paints if the surface is scuff-sanded:
 - Poster colors
 - Acrylic paints
 - Tempera
 - India ink
 - Latex-based pigments
 - Lacquers
 - Acrylic Lacquers
 - Two-part polyurethanes
 - Vinyls
 - Some water-based paints may also be suitable, depending upon the application.

Adhesion Test

- a. The paint system chosen should always be tested for adequate adhesion. To test for adhesion, conduct the Cross Hatch Test after the paint has dried for at least 24 hours:
 1. Make 11 parallel cuts 1/16” apart with a razor blade knife. Make 11 similar cuts at 90 degrees to cross the first set.
 2. Across the scored area apply a strip of strong tape, such as #610 Scotch tape. Press firmly.
 3. Immediately remove the tape by pulling it back upon itself at 180 degrees in one rapid motion.
 4. There shall be no removal of the paint squares to obtain a good adhesion rating.

Application

- a. Paints can usually be applied with a brush or roller, although conventional air spray equipment will provide a more consistent appearance.
- b. Consult paint manufacturer’s literature for recommended application technique and thinning requirements.

Drying

- a. For drying and cure times, consult paint manufacturer’s literature.
- b. Due to the wide variety of paint products on the market, testing is recommended for initial use of any coating system before commercialization.

SECTION VI: CUTTING

General Notes

There are many different methods in which “cutting” can be accomplished. This guide focuses on five primary cutting methods:

- Knife Cutting
- Shearing
- Saw Cutting
- Routing
- Die Cutting / Punching

None of the aforementioned methods require cutting lubricants, oils or coolants. When necessary, laying out a pattern on the surface of the substrate is best achieved with a soft pencil.

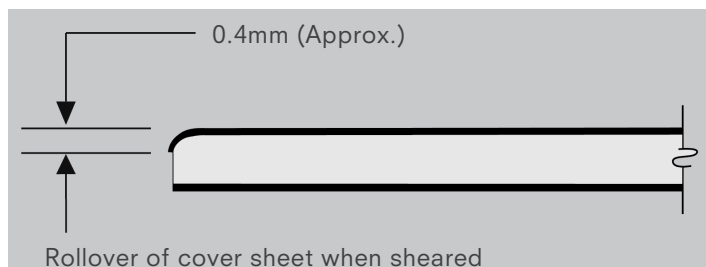
Knife Cutting

The substrate is not recommended for this fabrication method.

Shearing

The substrate can be easily sheared. However, a slight roll-down of the aluminum cover sheet may occur on the impact side. This “roll-down” area is often referred to as the “edge zone.” In this area, the polyethylene core is compressed and can lead to increased stress between the core and the aluminum cover sheet. Due to this additional stress, shearing should be avoided when the edge of the panel is exposed to the environment. When shearing the substrate, light markings on the material may be caused by the hold down pads. In order to avoid these markings, the hold down on the shear should be fitted with a shock-absorbing rubber pad to prevent damage to the substrate.

Figure 1 - Shearing



Saw Cutting

The substrate is manufactured with a Polyester paint finish. Care should be taken to protect the finish during any sawing operation. In some cases it is best to move the saw blade rather than the substrate when sizing the panels.

1. Table Saws

- Blades should be Carbide tipped or High Speed Steel designed for cutting non-ferrous materials, ground thinner from the rim towards the center to prevent pinching.
- The blades should have angled or circular teeth, alternate beveled, triple ground with the tooth gap wall rounded.
- The chip angle should be 5 to 15 degrees with a clearance angle of 10 to 30 degrees and a tooth spacing of 3/16" to 1".
- Cutting speeds of 5,500 RPM and feeds of 16"/second are possible.

NOTE: Table saws are not recommended for cutting sheets larger than 4'x4' in size.

SECTION VI: CUTTING

Saw Cutting (cont'd.)

2. Panel Saws

- a. Panel saws provide an effective method of cutting the substrate. These saws, whether standard equipment or custom made, perform well and have the added advantage of space savings.
- b. Blades should be the same type used for table saws.

3. Rip / V-Grooving Saws

- a. These saws are typically used for high volume production operations.
- b. Blades should be the same type used for table saws.

4. Circular Saws

- a. Circular saws are also used effectively to cut the substrate. These saws should be production/industrial type equipment.
- b. Blades should be the same type used for table saws.

5. Reciprocating Saws

- a. Reciprocating saws work well for cutouts. Care should be taken with portable and reciprocating saws to prevent damage to the substrate surface.
- b. More than one sheet can be cut at a time by stacking panels.
- c. If center cutting (i.e. Letter cutouts) is required, a foam pad may be placed under the substrate with the reciprocating blade cutting into the foam.
- d. The sheets may be clamped or secured with double-faced tape for the cutting operation. When clamping between jaws, protect the panel surface against damage.
- e. Blades should be high speed steel, .03" to .047" thick, 3/16" to 9/16" wide, with hook or circular teeth with alternate angles, set or waved at a spacing of .010" to .250".
- f. Cutting feeds up to 4"/second are possible.

6. Band Saws

- a. Band saws may be used to cut irregular shapes or curves.
- b. Blades should be tempered spring strip steel, .03" to .047" thick, 9/16" to 1" wide, with skip teeth designed for non ferrous and ferrous materials spaced at a minimum of 10 teeth per inch.
- c. Cutting speeds of 10,000 FPM at a cutting feed of 10"/second are possible.

SECTION VI: CUTTING

Routing

The substrate can be cut to size using either portable commercial or automated routing equipment. Bits should be carbide tipped and kept sharp. Single or multiple flutes may be used.

1. Routing for Bending - General

The substrate can be accurately folded by hand after a simple routing operation is done on the back skin. This fabrication method is called Rout and Return. It is unique to metal composite panel fabrication. Do not use a press brake for tight folds of the substrate. The material may be routed by using one of the two following methods:

- Hand operated routers equipped with modified 90-105 degree "V" bits (See figure 1) can be used effectively to remove material for folding.
- Table or circular saws can be equipped with a special blade (See figure 2); these blades referred to as "V" routing blades produce very close tolerances at a much faster rate than hand routers.

Figure 1 - Router Bits

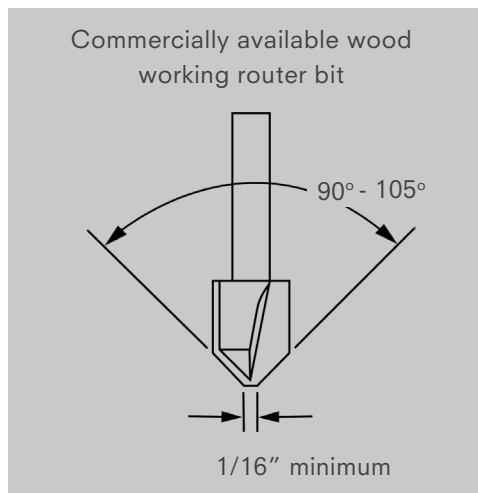
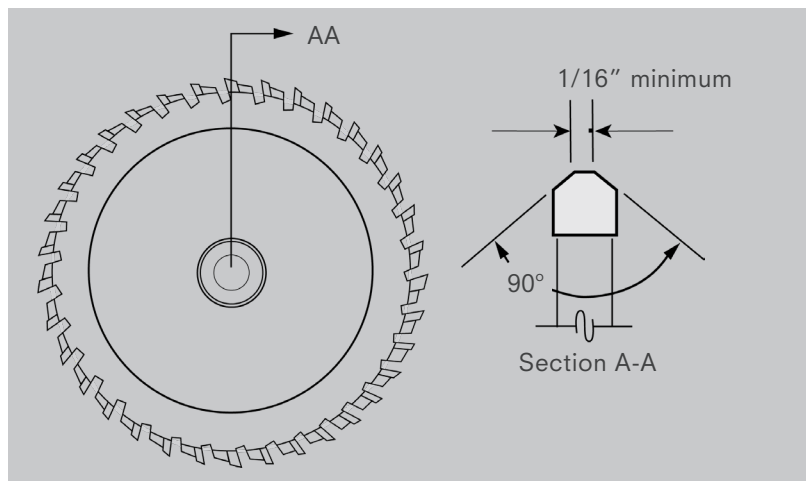


Figure 2 - Routing Saw Blade ("V" Routing blade)



SECTION VI: CUTTING

Routing (cont'd.)

1a. Routing for Bending - Small Radius

A very small radius can be achieved by "V" routing and folding. The depth of the "V" rout is critical. As a general guide line, the exterior aluminum skin should be visible through the polyethylene core at the valley of the rout; this visual appearance should be consistent along the entire length of the rout (See figure 3). Constant depth of the rout ensures a good smooth line when the fold is made. Extreme care should be taken not to score the exterior aluminum skin with the cutter.

By changing the shape of the cutter used, a larger radius can be achieved. A flatter, wider cut will result in a smoother bend (See figure 4).

Figure 3 - "V" Routing

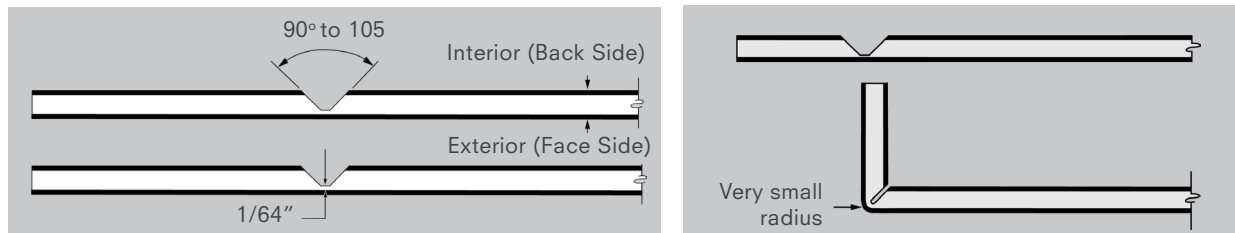
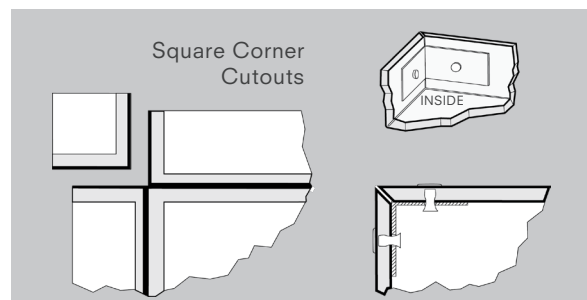
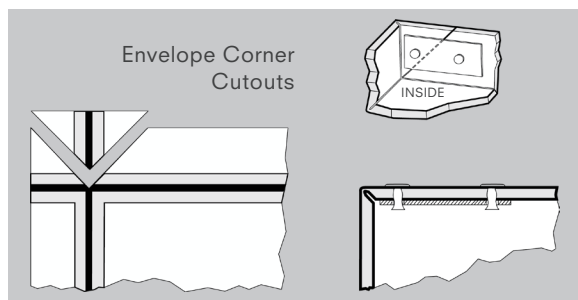
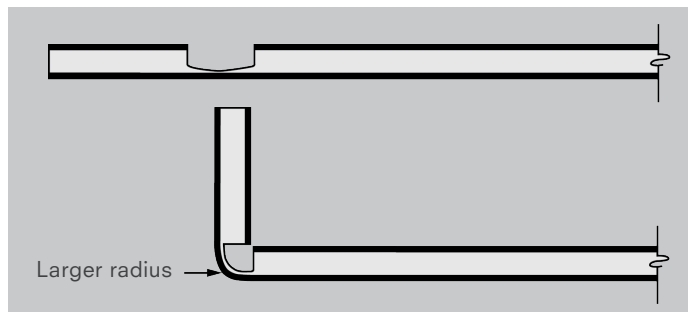


Figure 4 - Flat Routing



SECTION VI: CUTTING

Routing (cont'd.)

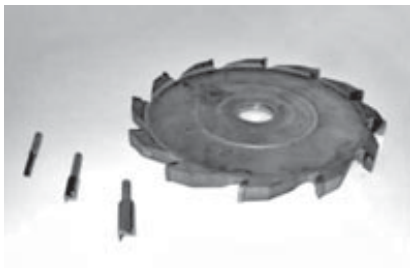
2. Making Corners

An aluminum composite panel requires a “grooving” operation along any fold line prior to bending. This operation can be done with a custom saw blade or a customized router bit. Regardless of the tooling used the groove is commonly called a “rout.” The most common rout is a modified “90° V” with a flattened (1/8” wide minimum) bottom. The reason for this modification is so that the aluminum skin does not overstress during the bending process. Once correctly done, this V-Rout allows the composite panel to be folded along the rout from 0° to 90° easily. The term “Rout and Return” means that a panel has been routed and the edge returned or folded.

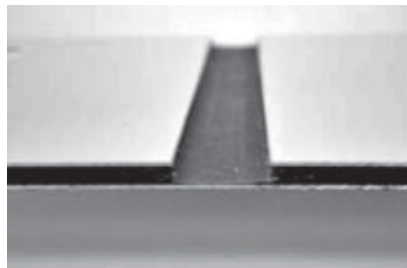
b. A rout made with profiles other than 90° allows the substrate to be bent to various angles. These profiles eliminate fabrication problems and combine to create different joining techniques. Two additional common router profiles discussed in this document are the 135° and the Flat Rout.

2a. Flat Routed Corner

a. This routed profile can be made with tooling of various widths. Once made, it allows the corner to curve gently and not be as sharp as the 90° V-Rout.



Flat Router Bit & Saw Blade



Flat Routed Dibond



Corner with Flat Rout

2b. Flat Rout Distorted to Eliminate “Bumps” in Curved Corner

The Flat Rout can also be folded anywhere within the “flat rout” to create a sharp 90° bend. This sharp 90° bend is sometimes used in the fabrication of a rout and return curved corner panel to eliminate the “bumps” at sawed relief cuts. The panel below has a gusset for reinforcement.



Distorted Flat Rout Folded 90°



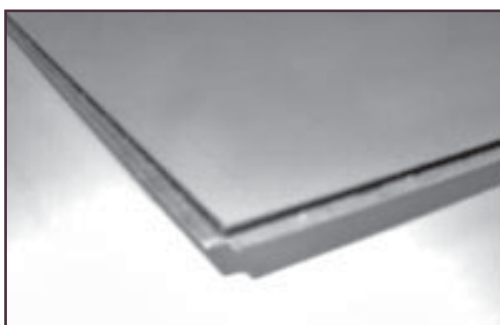
Rout & Return Curved Corner

SECTION VI: CUTTING

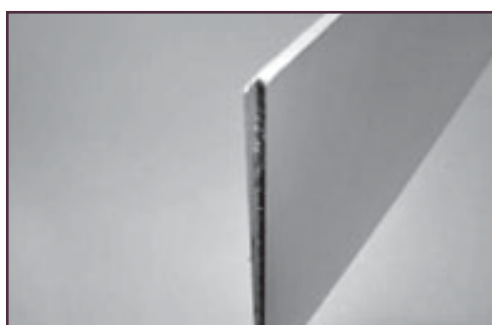
Routing (cont'd.)

2c. Flat Rout Used to Make a "Hem and Cope"

a. The only time a rout is set to a depth to remove the entire core material is when a "Hem" or "Cope" is needed. Both are made using a flat rout. A cope makes a support (sometimes called a rabbet joint) at the edge of the substrate. It is generally routed to the same width as the substrate thickness. A hem is made by first cutting a cope and then bending the remaining skin over the core material. These two flat routed conditions can be used independently or together to solve many fabrication needs.



Cope at Edge of Panel



Folded Cope (A Hem)



Cope at Edge of Panel



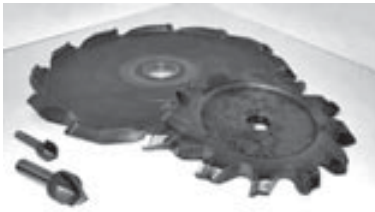
Folded Cope (A Hem)

SECTION VI: CUTTING

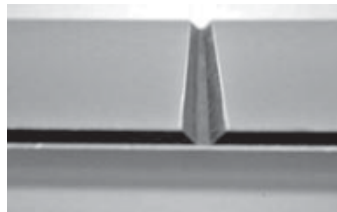
Routing (cont'd.)

3. 90° Corners

The most common corner is a 90° Rout and Return. This corner is made by folding a V-Routed panel to a 90° angle. It is critical that the modified V-Rout is made to the correct depth to create a good return angle. "Spring back" will occur if the rout is not deep enough, however, extreme care should be taken not to score the exterior aluminum skin with the router bit or blade during the routing operation so that the aluminum skin is not weakened. The depth is correct when the exterior skin is intact with approximately 1/64" of polyethylene in the bottom of the V-Rout and the return does not "spring back" when folded.



90° V-Router Bits & Blades



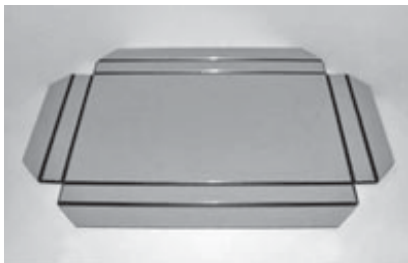
Modified V-Rout in Dibond



Folded V-Routed Corner

3a. Multiple 90° Corners

The solid core of the substrate allows the panel to be routed at any location. Wherever a fold is required, a rout can be made. Rout, notch, fold and reinforce with a gusset (back-up plate), and a "dimensional" panel can be easily made.



Flat Panel Routed & Notched



Panel Folded & Gusseted

3b. 90° Corner with Sawed Relief Cuts

A rout and return curved corner requires the curved portion of the return to be relieved to allow the substrate to curve. These "relief" cuts can be made with a router or a saw cut. They must be done carefully to prevent "bumps" being visible at the end of the relief cuts and showing on the exterior of the substrate. The pictures below show this type of corner reinforced with a gusset and the "bumps" visible along the curved edge.



Curved Panel with "Bumps"



Gusset Shown (Inside View)

SECTION VI: CUTTING

Routing (cont'd.)

3c. 90° V-Routed & Trimmed

There are instances when the “return” is trimmed or removed flush with the back of the substrate. One example is when a rout and return panel is fabricated into a curved panel. This method allows the outer skin of the substrate to be rolled without distortion. The substrate is first V-Routed and the return is removed at the correct location. The substrate is then curved and the return reinforced with a gusset. A filler plate has been added to form a Rout and Return Corner panel. This method eliminates “bumps.”



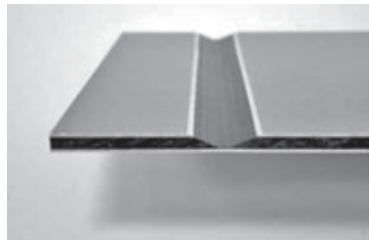
Corner Panel with Gusset & Filler Plate

4. 135° Profile

This profile allows the panel to be folded to a 45° angle. This is useful when it is necessary to join two panels at a 90° corner.



135° Router Bit & Saw Blade



Modified 135° Rout



Two 45° Corners Riveted to Make a 90° Corner

SECTION VI: CUTTING

Die Cutting / Punching

Die cutting and/or punching is a method for the rapid production of flat shapes or cutouts. Typical applications would include the die cutting of:

- Letters and shapes.
- Openings in a sheet used as part of an assembly
- Puzzle pieces

Die cutting and punching processes are similar in that they both can provide a curved shape by cutting through a substrate. Die cutting, however, uses one steel rule die that comes in contact with a flat platen, whereas, a punch has two designed shapes, a male and a female that cut the shape when pressed together.

Die cutting is typically used with lighter weight paper or foam type materials, where punches are used for heavier materials.

Prior to die cutting, the substrate can be painted or screen printed.

1. A Note on Punching

The punching of holes or flat-formed parts using the substrate is performed in the same way as for solid aluminum sheet. Evenly ground tools and the narrowest possible cutting gap will provide the best results. The substrate can be punched with a male-female die.

2. Steel Rule Die Cutting Process

The substrate is not recommended for this fabrication method.

SECTION VII: FORMING CURVES

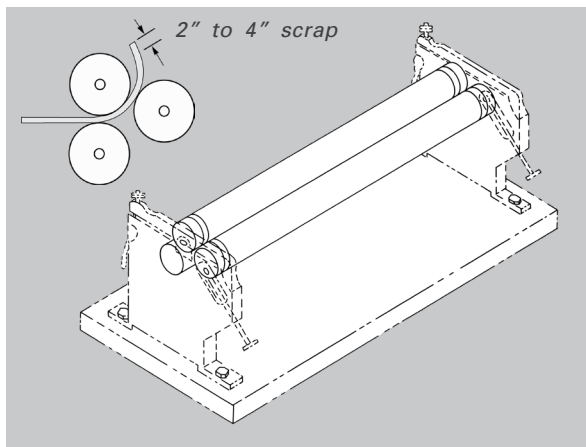
Curving Through Cold Forming

For forming curves requiring cutting techniques, see Section on Cutting.

The minimum curving radius of the substrate without routing the back skin is 30 times the thickness of the material. For example, using a 2mm thick sheet: $2\text{mm} \times 30 = 60\text{mm}$ radius (2-3/8"). The substrate may be curved using one of the three methods common to the sheet metal industry:

1. Pyramid Roller

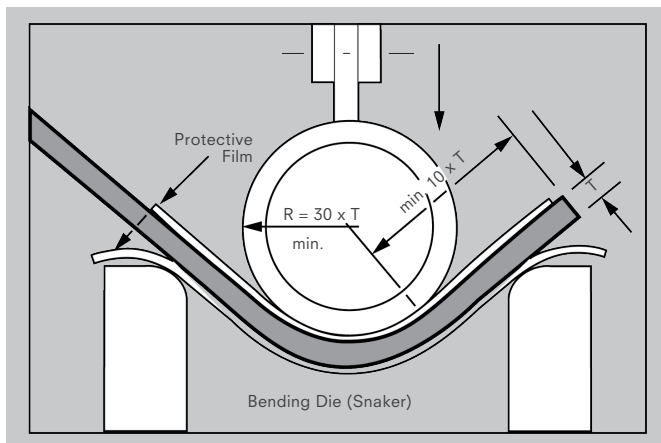
The use of a pyramid roller to curve the substrate is an acceptable method of obtaining a radius. As a precaution, film should be used between the substrate and the rollers to protect the substrate surface.



1. Make sure rollers are clean
2. Use protective material between rollers and DIBOND material - top and bottom
3. Adjust rollers for thickness (3mm, 4mm, 6mm)
4. Allow 2" to 4" scrap at each end

2. Press Brake

1. When forming with a brake press, use a top die with the desired radius.
2. The lower die should always have a protective film of less than 1/8".
3. The radius of the top die will be the approximate inside radius of the finished panel.
4. The end of the substrate should extend at least 10 times its thickness from the tangential contact point of the bending die.



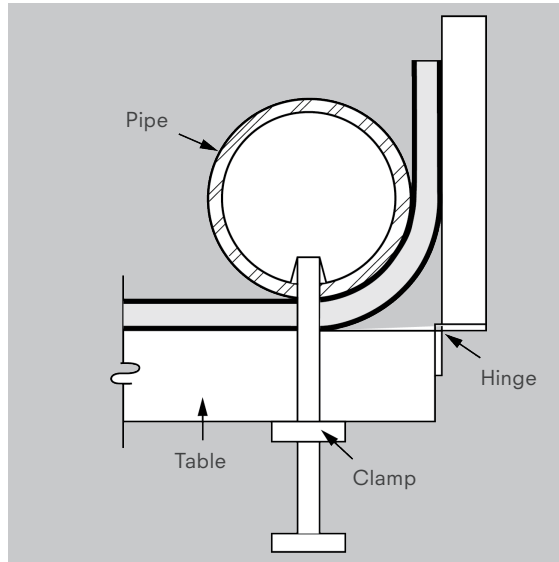
R - Radius
T = Thickness

SECTION VII: FORMING CURVES

Curving Through Cold Forming (cont'd.)

3. Bending Over a Clamped Pipe

The substrate may be bent over a pipe of desired radius that is securely clamped to a table. A hinged "leaf" attached to the end of the table will bend the substrate easily.



APPENDIX I: SDS

SECTION I - PRODUCT IDENTIFICATION

TRADENAME:

DIBOND®

SYNONYM:

Aluminum Laminated Construction

MANUFACTURER'S NAME & ADDRESS:

3A Composites USA, Inc.
208 W. 5th Street, P.O. Box 507
Benton, KY 42025
(270) 527-4200

EMERGENCY TELEPHONE:

Chemtrec - 1-800-424-9300

To be used only in the event of chemical emergencies involving a spill, leak, fire, and exposure accidents involving chemicals.

SECTION II - MATERIAL IDENTIFICATION AND INFORMATION

INGREDIENTS (Common Name)	PERCENT (%) (By wt.) ¹	OCCUPATIONAL EXP. LIMITS (OSHA) (mg/m ³)
Polyethylene (CAS #9002-88-4)	39-72	10.0 Total ⁽²⁾ 5.0 Resp.
Aluminum ⁽³⁾	28-61	15.0 Total ⁽²⁾ 5.0 Resp. ⁽²⁾

SECTION III - PHYSICAL PROPERTIES

APPEARANCE AND ODOR: Composite sheet material, odorless

MELTING POINT: 593°C / 890°F

SPECIFIC GRAVITY: 2.70 - 2.73 g/cm³ range

SOLUBILITY: Insoluble in water

¹ Concentration of ingredients depends upon the thickness of the material.

² These products are not considered to be a health hazard in the form in which they are sold(sheet, panel). However, if these products are abraded, melted, welded, cut or processed in any manner that causes release of fumes or dusts, hazardous levels of fumes or dust may be generated from these materials or constituents of these materials. Dust from these materials is regulated as particulate, N.O.S.

³ This product is not considered to be a health hazard in the form in which it is sold(sheet, panel). However, if this product is abraded, melted, welded, cut or processed in any manner that causes release of fumes or dusts, hazardous levels of fumes or dust may be generated from these materials or constituents of these materials. Aluminum fumes or dust are subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

APPENDIX I: SDS

SECTION IV - FIRE AND EXPLOSION DATA

AUTO IGNITION: Composite - (ASTM D-1929) 768 °F, 409 °C

EXTINGUISHING MEDIA: Water, foam, CO₂, dry chemical powder

SPECIAL FIRE FIGHTING PROCEDURE: Toxic gases may form upon combustion. Respiratory protection is recommended.

THERMAL DECOMPOSITION: May produce carbon monoxide, carbon dioxide, organic vapors

SECTION V - REACTIVITY DATA

STABILITY: Stable

INCOMPATIBILITY: None Known

DECOMPOSITION PRODUCTS: Reference "Thermal Decomposition", Section IV

CONDITIONS TO AVOID: None Known

SECTION VI - HEALTH HAZARD DATA

These products are not considered to be a health hazard in the form in which they are sold (sheet, panel). However, if these products are abraded, melted, welded, cut or processed in any manner that causes release of fumes or dusts, hazardous levels of fumes or dusts may be generated from these materials or constituents of these materials.

EFFECTS OF OVEREXPOSURE:

ACUTE: Physical irritation of the eyes may result from overexposure to high concentrations of dust or chips from certain fabricating operations. Overexposure to high concentrations of respirable dust may result in pulmonary fibrosis.

CHRONIC: Repeated long term inhalation of high concentrations of respirable dust may cause inflammation of the upper and lower respiratory tract.

SPECIAL PRECAUTIONS: Avoid prolonged inhalation of high dust concentrations and ingestion of material. Wash hands before eating, drinking or smoking. Wear proper eye and respiratory protection when working in areas of high dust concentrations.

EMERGENCY & FIRST AID PROCEDURES: For dust contact with eyes, wash immediately under water for at least 15 minutes. For dust inhalation exposure, remove to fresh air. Contact a physician.

APPENDIX I: SDS

SECTION VII - STORAGE, HANDLING, AND DISPOSAL DATA

WASTE DISPOSAL: Care must be taken when using or disposing of material debris to prevent environmental contamination. Dispose of the debris in accordance with the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act and all state or local laws / regulations regarding disposal.

STORAGE AND HANDLING PRECAUTIONS: Store in a flat dry area. Handle carefully to avoid scratching product finish. Caution should be taken to avoid sharp edges.

SECTION VIII - PERSONAL PROTECTION DATA

PRIMARY ROUTES OF ENTRY: Inhalation and ingestion of dust concentrations.

RESPIRATORY PROTECTION: An approved NIOSH/MSHA respirator must be used when engineering controls cannot be implemented to control dust concentrations. Reference OSHA 1910.134 for specific requirements.

VENTILATION: Local exhaust. Reference OSHA 1910.94f or specific requirements.

EYE: Eye protection must be worn when working in dust concentrations and during sawing or other operations which might cause flying debris. Reference OSHA 1910.133 for specific requirements.

PROTECTIVE GLOVE: Gloves should be used to prevent cuts or scrapes.

IMPORTANT:

The information and data contained herein are believed to be accurate and have been compiled from sources believed to be accurate. All information contained herein is offered for your consideration, information, investigation, and verification. 3A COMPOSITES USA, INC. MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, CONCERNING THE ACCURACY OR COMPLETENESS OF THE INFORMATION AND DATA HEREIN. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE SPECIFICALLY EXCLUDED. 3A Composites USA, Inc. will not be responsible for claims relating to any party's use of or reliance on information and data contained herein regardless of whether it is claimed that the information are inaccurate, incomplete, or otherwise misleading.

APPENDIX II: SPECIFICATIONS

Adhesives

Adhesives Used with DIBOND Material

One of the display features in great demand is the ability to attach DIBOND material to a substrate without having exposed fasteners. Although there are some techniques to accomplish this using conventional fasteners, the vast majority of this type connection is done using adhesives. To develop some general guidelines, 3A Composites USA Inc. has reviewed some well-known adhesives and can present the following information.

The following General Guidelines have been established based on the research done into the use of adhesives on DIBOND material.

- i. To achieve reliable bonding, it is imperative to follow the adhesive manufacturer's application instructions.
- ii. Although many adhesive materials work well on the coil coated paint finishes on DIBOND, no product, either adhesive or tape, has been found that will adhere to the polyethylene core material. All attachments should be made through contact with the painted aluminum facers of DIBOND.
- iii. Care must be taken in the selection of an adhesive regarding the thermal expansion of the materials to be joined. Where significant thermal expansion can occur (i.e. exterior applications) adhesives should be of medium or low modulus materials to allow for movement without shear or loss of bond. For interior applications where thermal expansion is not a consideration, high modulus adhesives can be used to join materials.
- iv. Cure time is generally a consideration in the choice of adhesives. Silicones take a good deal of time to cure before a load can be applied whereas the faster curing adhesives do not have the movement capabilities to meet the project needs. In these instances, a combination of double sided foam tape and adhesive is often used.

Example:

Two pieces of DIBOND must be connected for a strong permanent bond in a short period of time. The adhesive area is 2" by 36".

Many times a strip of double sided foam tape (approx. 3/4" wide) will be applied next to a bead of silicone adhesive. For the near term, the tape holds the DIBOND. For the longer term, the silicone adhesive will cure and relieve the load applied to the tape.

Adhesive Research Results

The following adhesives have been shown to adhere to DIBOND. For specific questions about the adhesive, please refer to the adhesive manufacturer guidelines.

Isopropyl alcohol two-cloth cleaning method is a minimal surface preparation for all adhesive bonding.

1-PART SILICONES, ADHESIVES, & SEALANTS

- Dow 995: 1-part silicone structural adhesive
- Pecora 864, 890, 895: 1-part silicone sealant
- Tremco Spectrem 1, Spectrem 2, Proglaze SG: 1-part silicone sealant
- Schnee Morehead SM5731, 1-part silicone sealant
- GE SCS2800, SCS9000, SCS2000, SCS2900, GE7000, 1-part silicone sealant

Isopropyl alcohol two-cloth cleaning method is a minimal surface preparation for all adhesive bonding.

APPENDIX II: SPECIFICATIONS

Adhesives (cont'd.)

1-PART SILICONES or URETHANE ADHESIVES / SEALANTS REQUIRING PRIMER:

- Dow 790, Dow 795: 1-part silicone sealant
Surface preparation: solvent wipe and Dow Corning 1200 Prime Coat required.
- Tremco Dymonic: 1-part polyurethane sealant
Surface preparation: Isopropyl alcohol two-cloth cleaning method, primer #6

1-PART METHACRYLATE, URETHANE, AND EPOXY ADHESIVES:

- Lord 406/19 (methacrylate), 7542AB, 7545AB (urethane)
- Extreme Adhesives 300, 310, 350, 5315, 5375 methyl methacrylate
- IPS Weld-On 45, Weld-On SS515 (methacrylate)
- Scotch Weld 3M 2216 (epoxy with long working time): Scuffing required

Isopropyl alcohol two-cloth cleaning method is a minimal surface preparation for all adhesive bonding.

The adhesive manufacturers have reported that, Lord 406/19 and IPS Weld-On 45 may also be used on un-primed aluminum. Testing on this substrate was not included in this report.

SYNTHETIC RUBBER AND 1-PART URETHANE ADHESIVES:

- Lord 7610 (1-part urethane): Scuffing required
- Schnee-Morehead SM7108 (1-part urethane)
- Liquid Nails LN-901 (synthetic rubber)

Isopropyl alcohol two-cloth cleaning method is a minimal surface preparation for all adhesive bonding.

ACRYLIC FOAM TAPE:

- 3MTM 4845 Acrylic Foam
- YHB Tapes

SUMMARY:

Many different types of adhesives and tapes have been found to work well with DIBOND. It is important to follow the guidelines listed above and to experiment with any new adhesive or technique prior to generating the final product. For adhesive manufacturer contact information, please see Appendix II: Products For Use.

APPENDIX II: SPECIFICATIONS

Fastening

Joining DIBOND Material

Typical methods of joining DIBOND are the use of threaded fasteners, rivets, adhesives and double-faced high strength tapes. Proper consideration should be given to the thermal expansion characteristics of DIBOND. See Thermal Expansion Section. Use the general guidelines listed below when other elements come in direct contact with the surface of DIBOND. It is always recommended to trial application various joining techniques to ensure success.

i. ACCEPTABLE JOINING ELEMENT MATERIALS:

- Aluminum
- Plastic
- Stainless Steel

ii. UNACCEPTABLE JOINING ELEMENTS:

- Copper
- Brass
- Bronze
- Iron
- Raw Steel

Unacceptable materials may cause corrosion of joining surface due to electrolysis of dissimilar materials.

Threaded Fasteners

Threaded fasteners will allow the removal of the panel if needed. The use of a large flat washer will aid to minimize surface pressure and possible compression due to cold flow of the core material. Placement of the threaded fasteners should not be less than .75" from the edge of the sheet. It is not recommended to torque fasteners due to the cold flow of the core material, one turn past finger tight is common practice.

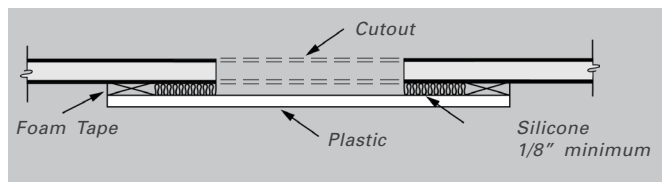
Rivets

Panels of DIBOND can be fastened together or joined to aluminum extrusion profiles with rivets common to aluminum construction. Rivet connections are well suited for parts that may be subjected to vibration. Colored plastic concealment caps can be used to conceal the exposed rivet head. Consult the rivet manufacturer for details.

Adhesives

For interior design purposes, high strength contact adhesives that do not require lengthy setting times can be used. Where moderate cure times are acceptable, construction adhesives and silicones can be used to obtain a stronger bond than with contact adhesives.

When using an adhesive to hold dissimilar materials, select one that will allow thermal differential movement without shearing. Use a low modulus sealant where greater amounts of movement are expected (i.e., plastics to DIBOND), and medium modulus sealants if minimum movement is expected (i.e., bonding aluminum to DIBOND).



Tapes

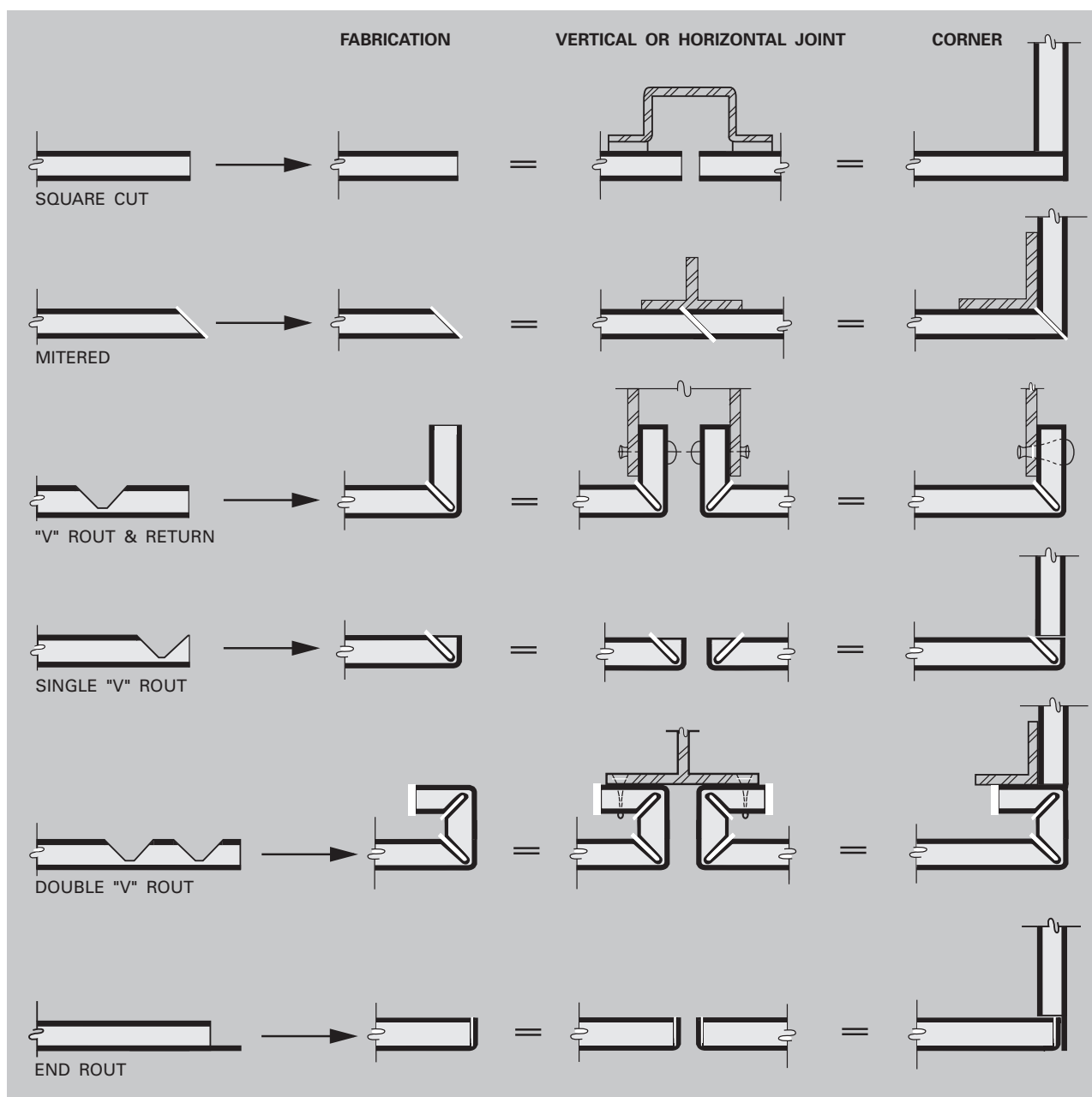
For stress-free applications and to hold parts while the primary adhesives cures, double-faced foam tapes are effective. Both surfaces to be bonded must be clean and dry. It is important that the tape manufacturer's directions are followed for best results.

APPENDIX II: SPECIFICATIONS

Concepts

The following details are provided for conceptual purposes only. These are not the only methods that can be used to attach DIBOND, nor can they be used generically without consideration for each individual application. Good design for thermal expansion should influence the choice of details used.

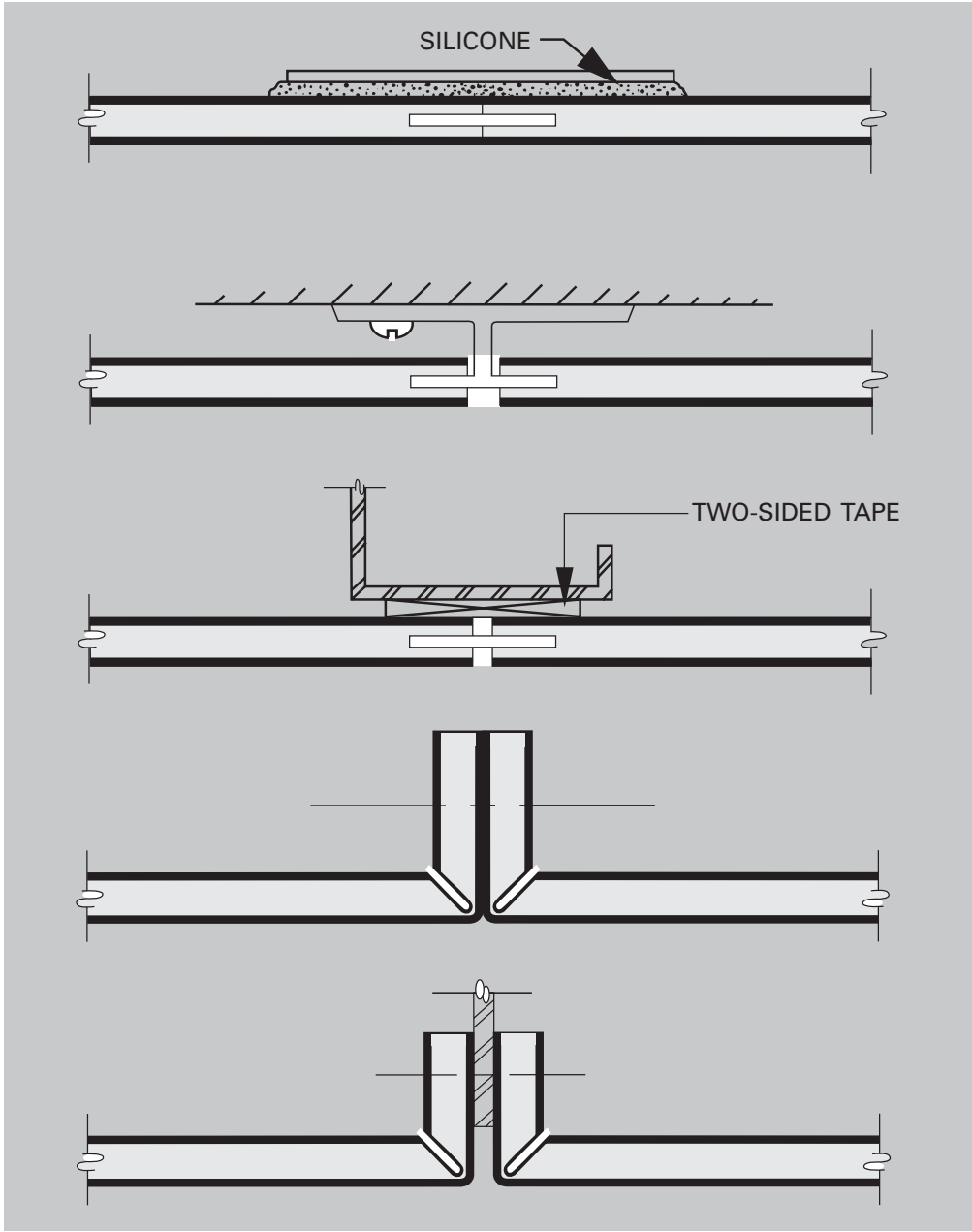
Details



APPENDIX II: SPECIFICATIONS

Concepts (cont'd.)

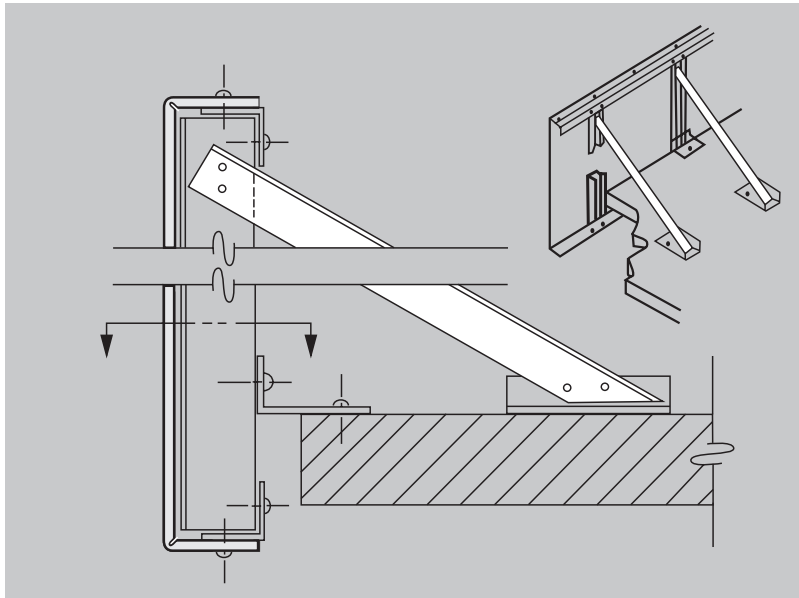
Exterior Joints - No Allowance for Thermal Expansion



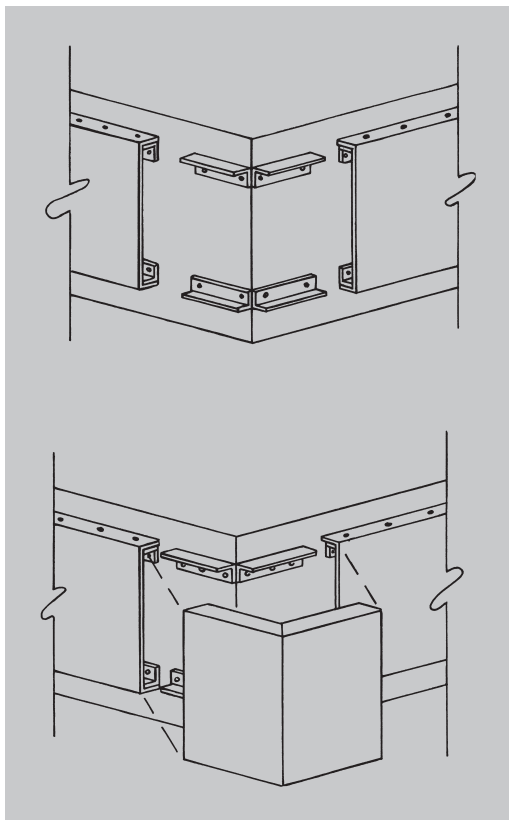
APPENDIX II: SPECIFICATIONS

Concepts (cont'd.)

Sign Band / Canopy / Fascia



Corners



APPENDIX II: SPECIFICATIONS

Drilling

DIBOND can be drilled with twist drills usually used for aluminum and plastics, and on drilling machines customarily used for metals.

WORKING SPECIFICATIONS:

Drill Bit: Twist drill, high speed steel

Tip Angle: 100-140 degrees, or counter-bore grind with centering tip

Cutting Speed: 164 RPM to 984 RPM

*Quick removal of chips can be achieved by a high RPM, slow feed speed and occasional lifting of the bit.

Thermal Expansion

Thermal expansion should always be considered in designs using DIBOND. DIBOND has been tested and has a rate of expansion of .000156"/FT/°F. That translates into approximately an 1/8" movement in an 8' panel with a 100°F temperature change. Temperature differences must be considered between shop (fabrication) temperature and the highest and lowest panel temperature. Care should always be taken to avoid restricting thermal movement of the panel to eliminate unacceptable bowing or over stressing of the fasteners.

The coefficient of expansion for unlike materials should be considered in joint design.

Storage Guidelines

DIBOND is to be stored inside in a dry and clean area. Material must be stored flat.

DIBOND should always be stored in a cool dry area where temperatures are relatively stable. Excessive temperature fluctuations may cause condensation to form on the stored sheets possibly resulting in permanent damage. Do not allow moisture to reach stored material.

The best way to store DIBOND is to lay it flat. If a rack storage system is decided upon, use the base of the crate as a bottom support for the material to rest on. If DIBOND is leaned on its side, it should be positioned to lean on the horizontal edge of the material only. DIBOND panels should be handled carefully when removing the panels from storage so that they do not slide against each other or so they don't slide over a rough surface to avoid panel damage. Vertical stacking of DIBOND is not recommended.

APPENDIX II: SPECIFICATIONS

Engineering Specifications

Panel Thickness			2mm	3mm	4mm
Thickness of aluminum skins			0.012 in		
Weight (lbs/ft ²)			0.60	0.79	0.98
Technical Properties					
Tensile Yield	ASTM D-638	PSI	8450	5580	4390
Ultimate Yield	ASTM D-638	PSI	8500	6220	5000
Elongation	ASTM D-638	%	7.6	12	13
Ultimate Flexural	ASTM D-790	PSI	20120	15050	12180
Flexural Modulus	ASTM D-790	KSI	1391	1430	1440
Flatwise Comp.	ASTM C-365	PSI	1026	739	790
Shear Strength	ASTM C-273	PSI	1637	1030	920
Thermal Cond. (K)	ASTM C-177	BTU-in/ hr.ft ² -°F	0.953	1.221	1.532
Thermal Rest. (R)	ASTM C-177	Hr.ft ² -°F/ BTU	0.084	0.097	0.103
Deflection Temperature	ASTM D-648	°F	Above 350	303	188
Moment of Inertia		in ⁴ /in	.00003	.000075	.000141
Section Modulus		in ³ /in	.00079	.00126	.00172
Alloy of Cover Sheets				3000 Series	
Linear Thermal Expansion				0.000012 in/in/°F	

APPENDIX II: SPECIFICATIONS

Post-Paint Finishes Chart

Supplier	Surface Preparation	Primer	Top Coat
Akzo Nobel 800-233-3301 or 770-662-8464	Degrease with Grip-Gard® M-600 Wax & Grease Remover. Sand surface dry with 320-360 grit paper.		Grip-Gard®
	Degrease with Grip-Gard® M-600 Wax & Grease Remover		Grip-Gard® HS Grip-Gard® Plus Meta-Flex®
Carbit Paint Co. 312-280-2300	Clean surfaces with a 50/50 blend of isopropyl alcohol and water		Carbithane® 11 Series Carbithane® 12 Series
Dupont Industrial Coatings 800-338-7668	Scuff sand with red Scotch-Brite pad, clean with H-69 isopropyl alcohol		
	Scuff sand with red Scotch-Brite pad, clean with H-69 isopropyl alcohol	Imron® 1.5 Waterborne Copolymer Primer WF	Imron® 1.2 Waterborne Copolymer WG
	Scuff sand with red Scotch-Brite pad, pad, clean with H-69 isopropyl	Corlar® VHS 90P Epoxy Mastic Primer	Imron® 333 Line Polyurethane Enamel
Matthews Paint Co. 800-323-6593 or 262-947-0700	Wipe down with 45330SP Speed Prep Cleaner, abrade with 320/400 grit or red Scotch-Brite pad and wipe down with 45330SP Speed Prep Cleaner		MAP® VOC MAP® Satin VOC MAP®
One Shot, LLC 219-949-1684	Lightly scuff sand with gray Scotch-Brite pad and wipe down with isopropyl alcohol	5005 Acrylic Bonding Primer White	1 SHOT® Lettering Enamels, CHROMATIC Bulletin Colors
PPG Industries 800-441-9695	Lightly scuff sand and remove all forms of contamination; clean with solvent		PPG Duracryl® Acrylic Lacquer
T.J. Ronan Paint Corp. 800-247-6626 or 718-292-1100	Wipe with isopropyl alcohol (91%)		Bulletin Color, Lettering Enamel, Aquacote® (waterborne)
Sherwin Williams 700-331-7979 Thermal Cond. (K)		DTM Bonding Primer	DTM Acrylic Coating METALATEX Semi-gloss Coating
	Cleaning per SSPC-SP1 (Solvent cleaning)		Bond-Plex® water based acrylic coating
Spraylat Corp. 800-336-1936 or 914-699-3035 Deflection Temp.	Must be sanded or primed	Series 20/30 Wash Primer Polyurethane	Series 20 Acrylic Lacquer Series 30
	Scuff sand using Scotch-Brite Pad		Polycryl

APPENDIX II: SPECIFICATIONS

Screen Printing Inks

Ink Supplier	Solvent Inks	UV Inks
Naz Dar 913-422-1888	System 2 7200 9700	3200 w/ 5% NB 80 3600 w/ 5% NB 80
Sericol 800-737-4265	Uvipak PE Fast Dry Enamel HGXE SP Enamel	

APPENDIX II: SPECIFICATIONS

Certificate of Compliance

CERTIFICATE OF COMPLIANCE

Certificate Number 20181012-E101623
Report Reference E101623-19920908
Issue Date 2018-OCTOBER-12

Issued to: 3A COMPOSITES USA INC
208 W 5TH ST
PO BOX 507, BENTON KY 42025


This is to certify that representative samples of COMPONENT - SIGN ACCESSORIES
Structural sign panel material, designated "DIBOND" made 2 mm, 3 mm, or 4 mm of polyethylene laminated on two sides with aluminum.

Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: UL 879, Electric Sign Components
CSA C22.2 No.207-M89, Stationary and Portable Electric Signs and Displays


Additional Information: See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's Certification and Follow-Up Service.

The UL Recognized Component Mark generally consists of the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory. As a supplementary means of identifying products that have been produced under UL's Component Recognition Program, UL's Recognized Component Mark:  may be used in conjunction with the required Recognized Marks. The Recognized Component Mark is required when specified in the UL Directory preceding the recognitions or under "Markings" for the individual recognitions.

Recognized components are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. The final acceptance of the component is dependent upon its installation and use in complete equipment submitted to UL LLC.

Look for the UL Certification Mark on the product.



Bruce Mahrenholz, Director North American Certification Program
UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at <http://ul.com/about/locations/>



APPENDIX II: SPECIFICATIONS

Physical Product Specifications Chart

Target Thickness	2mm	3mm	4mm
Thickness Tolerance	+/- 0.008" (0.2mm)	+/- 0.008" (0.2mm)	+/- 0.008" (0.2mm)
Sheet Size Tolerances			
Width	0" + 0.188" (3/16")	0" + 0.188" (3/16")	0" + 0.188" (3/16")
Length	0" + 0.375" (3/8")	0" + 0.375" (3/8")	0" + 0.375" (3/8")
Diagonal	Max. 1/4"	Max. 1/4"	Max. 1/4"
Squareness (Straight Edges)	N/A	N/A	N/A
Warpage / Bow	Length or Width Max. 0.8%	Length or Width Max. 0.8%	Length or Width Max. 0.8%

DEFINITIONS

Target Thickness: The gauge that is to be focused on as optimum. The Gauge Range is then used to define the limits of the thickness that can be considered "in spec".

Thickness Tolerance: The upper and lower limits in thickness that a product can be manufactured making it "in spec".

Example: Target of 250mils with a range of + or - 25 mils would be 225 mils to 275 mils.

Sheet Size Tolerances: We measure width, length and diagonal. Width is typically cross machine, length is typically machine direction and diagonal is the difference in the diagonals.

Squareness: The difference in the lengths of the machine direction sides.

Warpage/Bow: This is measured by laying the sheet flat on a surface and measuring the amount of "smile" or "frown" in the center of the board in either the length or width. Should we have a problem described as "potato chip" this is a two direction warp, which is automatically "not in spec".

CONCLUSION

This Fabrication Manual has been developed to assist fabricators to work with the substrate in the most efficient and effective manner. The tips and suggestions contained in this manual are the result of many years of combined experience by fabricators in the U.S., Canada, South America, Asia and Europe.

These fabrication suggestions and product specifications are based on information which is, in our opinion, reliable. However, since skill, judgment, and quality of equipment and tools are involved, and since conditions and methods of using the substrate are beyond our control, the suggestions contained in this manual are provided without guarantee. We recommend that prospective users determine the suitability of both the material and suggestions before adopting them on a commercial scale.

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