FABRICATION
GUIDE

BOTOFOAM E
BOTOFOAM EP
BOTOFOAM S
BOTOFOAM SP
BOTOFOAM CO
BOTOFOAM CEL
BOTOFOAM COLOR

BOTO PLASTICS

Contents

Introduction to BOTOFOAM

BOTOFOAM PVC sheet is versatile, flexible, lightweight, and durable and is ideal for use in digital or screen printing, fabrication, and construction. Printers and display builders will benefit from its consistent, smooth, and bright surface for producing high-quality displays. It is easily handled, cut and fabricated using conventional tools and equipment, and can be printed, painted or laminated.

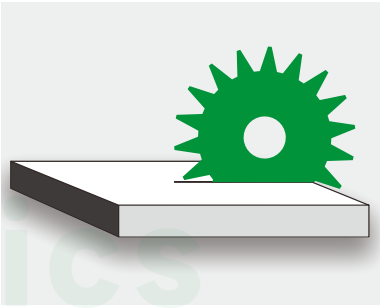
Main Benefits

- Ease of fabrication
- Lightweight
- Excellent chemical resistance
- Superior Insulating Characteristics
- Moisture Resistant
- High Flammability Ratings
- Heavy Metal Free

Cutting

Circular Saws

A BOTOFOAM PVC sheet up to 3 mm thick can be cut with a knife or blade. For a thicker one, carbide-tipped, high-speed steel blades commonly recommended for wood or plastic (hook type) can be used.
The following settings are recommended:



- **Rake angle:** 0 - 8
- **Clearance angle:** 10 - 15
- **Cutting speed:** 4,000 - 8,000 feet per minute
- **Feed rate:** 6 - 30 meters per minute
- **Tooth pitch:** 5 - 12 mm

Band Saws

High-speed steel blades, normally recommended for wood or plastic, can be used, provided the following guidelines are followed.

- **Teeth:** 6 to 8 per inch
- **Cutting speed:** 3,000 - 5,000 feet per minute
- **Feed rate:** 6 - 30 meters per minute

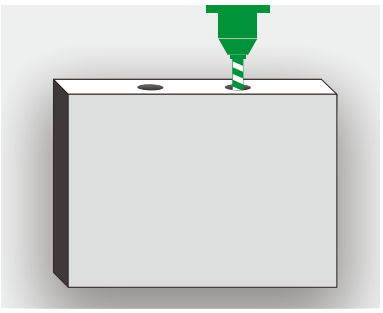
Saber Saws

Rough-cut type blades ground for plastics can be used on BOTOFOAM PVC sheet.
Smooth metal-cutting blades are not recommended.

NOTE: BOTOFOAM PVC sheet must not be laser cut.

Drilling

Drill the sheet with carbide-tipped bits using twist drills recommended for metals.
The following settings are recommended:



- **Point angle:** between 80 - 120
- **Rake angle:** 3 - 6
- **Cutting speed:** 1,000 - 3,000 rpm
- **Feed rate:** 0.1 - 0.5 mm / revolution

The minimum distance from the edge should be 2 times the hole diameter. To reduce heat buildup during drilling, it may be necessary to periodically remove the drill bit from the sheet.

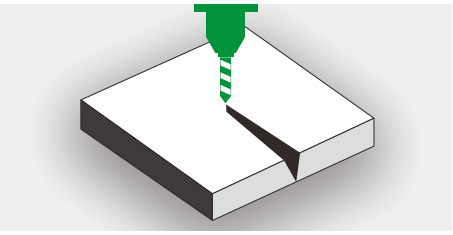
Milling

Use standard milling machines of various types utilizing the following guidelines:

- **Relief angle:** 5 to 10
- **Rake angle:** -10 to 0
- **Cutting speed:** up to 18000 rpm
- **Cutting Feed:** 0.3 - 0.5 mm / revolution

Routing

Use multi-fluted carbide tools on standard woodworking routers. Standard tools and machines can be utilized with no need to alter equipment. Adjust feed and speed rates as needed to achieve the best edge finishes.



Thermal Expansion / Contraction

As with most plastics, BOTOFOAM PVC sheet will expand and contract with temperature changes. This material property is known as linear thermal expansion and contraction. Since it can be used in a wide variety of indoor and outdoor applications, linear thermal expansion and contraction may need to be considered during fabrication and installation. It is important to consider the temperature at which the sheet was fabricated, as well as the installation temperature. It is not recommended to use the sheet in applications or climatic conditions exceeding 60°C (ambient or surface temperature), at which temperature the sheet will soften and permanently deform. Dark colors are generally not recommended for outdoor use, as they absorb heat and can easily exceed the maximum allowable temperature of 60°C.

BOTOFOAM Linear Expansion / Contraction Quick Reference

Total Temp. Change (△)	Expansion / Contraction of Material at Standard Lengths / Widths (in inches)			
	48 in.	60 in.	96 in.	120 in.
20°F	0.040	0.048	0.075	0.093
40°F	0.075	0.093	0.146	0.182
60°F	0.111	0.137	0.217	0.270
80°F	0.146	0.182	0.288	0.359
100°F	0.182	0.026	0.359	0.448
120°F	0.217	0.270	0.430	0.537
140°F	0.253	0.315	0.501	0.626

Distances Between Fastening Points for Screw and Rivet Joints

Sheet Thickness	Distance Between Fastening Points
2mm	6 - 8 in.
3mm	12 - 16 in.
4mm	20 - 28 in.
5mm	31 - 43 in.
6mm	47 - 70 in.

Screwing and Nailing

Any screw or nail can be used to fasten the BOTOFOAM PVC sheet. Power nailers and screw driving equipment are suggested. Inserting the screw or nail into an elongated slot or an oversized hole is recommended so the material can expand or contract when temperatures fluctuate. For best results, use oversized washers or grommets in combination with screws.

Installation

BOTOFOAM PVC sheet is manufactured as an extruded foam PVC product with a directional grain running the entire length of the sheet. This manufacturing process gives it greater flexural strength in the extrusion direction. The sheet grain should always be installed perpendicular to the fastening point.

Exterior Signs

When used correctly and with basic mechanical fixing methods, it is suitable for exterior use. Using a BOTOFOAM PVC sheet can provide an excellent weatherproof substrate ready for screen printing, painting, or vinyl graphics.
NOTE: BOTOFOAM colored sheets are not suitable for long-term exterior applications as the UV rays in sunshine can lead to changes in color. Seasonal outdoor use may be considered.

Tips on Sign Installations with Posts

The following tips are intended as a general guide for fixing BOTOFOAM PVC sheets with minimal breakage. Unusual designs that fall outside the examples given may require modifications.

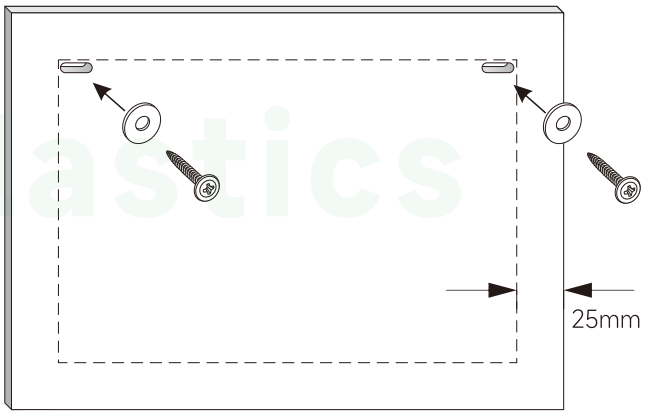
Significant Items to be Considered

1. Bolt holes should always be larger than the bolt shaft to allow for thermal expansion and contraction, thus eliminating the possible stress at bolt fixing points. The use of washers spreads the compressive load when bolts / nuts are tightened. Be sure not to over-tighten as this will weaken the connection.
2. Split timber posts are the best to use because the BOTOFOAM PVC sheet is supported evenly on both sides. If steel or aluminium poles are used, nylon bolts and washers give the best results. Be certain not to skimp on fasteners for these types of installation.They should be evenly spaced and away from the top and bottom edges.

Screwed Joints

For attaching the BOTOFOAM PVC sheet, basically, all known through-bolts are acceptable. For outdoor mounting, it is recommended that the bolt shank be passed through the sheet in prepared holes or suitably dimensioned slots, leaving adequate clearance between the bolt shank and the sheet.

The screws should only be tightened firmly enough to allow the sheet to expand and contract in all directions without warping or buckling. Tapping screws or screws with form-fitted passage of the shank through the sheet should be avoided but are allowed for interior uses with predictably low temperature variations. The diameter of the hole or length of the slot should not be less than 2.5 times the shank diameter of the fastener. Disc washers should be used to cover holes or bridge slots, and they should be large enough to ensure adequate load distribution. Precise centering of the screws in holes and slots is essential to permit free movement of the sheet in all directions.



Frame Fastening of BOTOFOAM PVC sheet

BOTOFOAM PVC sheet can be fastened utilizing various framing materials such as, but not limited to, wood, aluminum, steel and vinyl. Besides the inherent rigidity of sheets, which depends on thickness, all possible exterior stresses, e.g., wind pressure, must be considered when designing frame fastenings. For appropriate mechanical and elastic property values, consult the data sheet. Dimensional changes due to thermal expansion (or contraction) must be accounted for by leaving sufficient clearance between the sheet edge and the frame.

Hanging Signs

BOTOFOAM PVC sheet may be successfully used as interior hanging signs. As it is an extruded sheet product, thin gauges or large hanging signs may require additional support. The addition of an aluminum or thick-walled plastic “C” channel across the top, bottom, or around the perimeter may be needed to alleviate any tendencies to warp. When adding supporting channels is not an option, the method illustrated below can also help prevent bowing. Holes should be located 2-1/2 times the sheet thickness from the edge.

Adhesive Bonding of BOTOFOAM PVC sheet

General Information

BOTOFOAM PVC sheet can be readily bonded to itself or to other materials. Commercially available adhesives that are suitable for bonding rigid PVC materials can be used for this purpose.

There are several considerations when choosing an adhesive:

1. The material to be bonded with the BOTOFOAM PVC sheet
2. Strength required - structural vs. non-structural
3. Temperature range expected
4. Expansion / contraction
5. ase of application methods, curing times
6. Cost effectiveness
7. Environmental and safety considerations - flammability, fumes, odors, etc.

Surface Preparation

To attain the optimum bond, the sheet surfaces to be bonded must be cleaned and degreased using a white cloth soaked in isopropyl alcohol.

Selection of Adhesives

The selection of the proper adhesive for a project depends on the materials to be joined, as well as the end use and other considerations mentioned previously. The following suggestions serve as general guidelines:

A.Bonding two pieces of BOTOFOAM PVC sheets

1. For edge bonding and joining parts made of PVC material, use a PVC solvent such as THF, MEK, or cyclohexanone solvent systems.
2. For bonding large areas: If using PVC solvent such as pipe cement, spread with a notched trowel and work rapidly.

B.Bonding BOTOFOAM PVC sheet to Non-Porous Solid Material (such as PVC, other plastics or metal):

1. Contact adhesive with solvent:

a. Neoprene, nitrile, polyurethane or other synthetic rubber types.

b. Adhesive must be applied to both faces. Parallel beads of adhesive are often preferred because they allow solvent to evaporate, providing a faster cure.

c. Use a slow-setting adhesive when bonding large areas. This allows more time to properly install the panels before the adhesive cures.

d. For bonding to flexible PVC sheets, only plastizer-resistant types of adhesives should be used.

C.Bonding BOTOFOAM PVC sheet to Porous Materials (such as paper, textiles, fabrics or wood).

1. Contact adhesive with solvent: Same systems as for non-porous materials.
2. Construction mastic, structural silicone adhesives.

Considerations such as expected temperature ranges (expansion / contraction), substrate and size of BOTOFOAM PVC sheets should be taken into consideration when deciding on a method of attachment

Shaping and Forming

BOTOFOAM PVC sheet performance and characteristics may vary depending on the extrusion direction. Sharp corners and deep notches should always run at right angles to the direction of extrusion to minimise risks of breakage.

Cold Bending

BOTOFOAM PVC sheet up to 5mm thick can be cold-bent at room temperature. Care must be taken to observe the minimum bending radius of approximately 100 times the sheet thickness (e.g. 200mm for a 2mm thick sheet).

Vacuum Forming

BOTOFOAM PVC sheet can be fully formed and even embossed by vacuum forming. The sheet's temperature should be approximately 130°. Stretched areas in the sheet may appear lighter in color.

Heat Bending

BOTOFOAM PVC sheet can be thermoformed by heating it to approximately 130°C using radiant heaters, strip heaters, or air-circulated ovens. Heat guns can also be used in small areas. To achieve the best results, a rheostat should be used to control the sheet's heating temperature. Heating the sheet over 165°C can cause the surface to become rough and possibly discolor.

When using a metal contact strip heater, cover the heater strip with Teflon spray to prevent marking. Rectangular heating bars of different sizes can be used to produce bends of varying radii. The larger the heated area, the larger the radius that can be created. BOTOFOAM PVC sheet should be heated from both sides when the sheet is thicker than 4 mm. It requires heating at approximately 30 to 40 seconds per millimeter of thickness prior to bending.

To form tighter bends with smaller radii, use a small heated area on the upper surface (inside the bend) and a larger heated area on the bottom surface (on the outside of the bend) of the sheet. A minimum radius of twice the sheet thickness is necessary to avoid breakage. When bending into an angle, the sheet's extension on either side of the angle should be at least 20 times the sheet's thickness.

For example, a 6 mm sheet would require extensions of 120 mm on each side to avoid material warping. For sides less than 20 times the sheet's thickness, the entire sheet must be heated. Once the sheet is bent, please place it in a fixture, such as a jig or clamp, to cool. Fans and / or compressed air will speed the cooling process.

Painting

The painting is easily accomplished with paints known to have compatibility with rigid PVC.
The surface may need to be slightly sanded and treated with a primer coat before painting.
The selection of a paint system for each use should be guided by the following:

1. Cost effectiveness
2. Ease of application.
3. Safety and Environmental-odor, solvent systems, toxicity, etc.
4. Convenience and speed-one part vs. two-part, one coat vs. multiple coats.
5. Solvent and / or chemical resistance.
6. Outdoor weatherability & reflectance value.

(When painting with darker colors, for use in exterior applications, the paint must have a light reflectance value of 55 or higher to avoid excessive heat absorption, which will result in distortion of the sheet)

I. Types of paints known to be compatible with BOTOFOAM PVC sheet

A. Vinyls
B. Acrylic Lacquers
C. Two-part polyurethanes.

Water-based latex systems and oil-based enamels generally do not have the good adherence properties of solvent-based systems. Although primers can improve the adherence of non-solvent-based systems, the resulting adherence is usually minimal.

II. Surface Preparation

A. The surface to be painted must remain dry, clean, and grease-free.
B. Any surface scratches on the sheet will tend to telegraph through the paint. To remove small scratches or dents, quickly run a heat gun over the affected area. Care must be taken not to leave the hot air in one place for too long, as the surface may deform.
C. It is highly recommended that the surface be cleaned with a rag moistened with isopropyl alcohol prior to painting.

III. Adhesion Test

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 eleven parallel cuts 1/16" apart with a razor blade knife. Make eleven similar cuts at 90 degrees to cross the first set.
2. Across the scored area, apply a strip of strong tape, such as 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.

IV. 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 the paint manufacturer's literature for recommended application technique and thinning requirements.

V. Drying

It should not be dried at temperatures above 150° F. For drying and cure times, consult the paint manufacturer's literature.

CAUTION: Due to the wide variety of paint products on the market, and the fact that some paints have been known to embrittle or bow BOTOFOAM PVC sheet, testing is always recommended for the initial use of any coating system before commercialisation.

Graphic Applications

BOTOFOAM PVC sheet performs well in a wide range of graphic applications, including those involving paints, screen printing, digital flatbed printing and vinyl films. It can be used to create weather-resistant signs, displays or Point of Purchase (POP) materials. The smooth surface is ideal for all types of graphics and requires minimal surface preparation or treatment.

General Considerations

To ensure the best results for any graphic application using BOTOFOAM PVC sheet, consider the following factors that may affect the final installation:

- Environmental and safety concerns
- Weathering
- Chemical resistance
- Ease of application
- Cost-effectiveness
- Hardness
- Scratch resistance
- Priming or multi-coat paint applications

Tip: Because of the wide range of products available, select paints carefully for each application. Initial testing of the selected paint system is recommended before a production run.

Cleaning / Pretreating

Before screen printing or painting, the surface area should be cleaned with isopropyl alcohol and a clean white cloth. Depending on the specific application, certain pre-treatments may also be required, as described in the following sections.

Screen Printing

Screen printing is easily accomplished on BOTOFOAM PVC sheet. The sheet's surface has a closed-cell matte finish that makes mistakes easy to wipe off with the appropriate thinner. The use of Vinyl and Vinyl / acrylic, solvent-based inks is very compatible with BOTOFOAM PVC sheet.

Water-based screen-printing inks have also shown some success. Ink manufacturer directions must be followed for good adhesion. Surface preparation is like that of painting.

A. The surface to be screen-printed must remain dry, clean, and grease-free.

B. Any surface scratches will tend to shadow through the ink.

To remove small scratches or dents, rapidly fan a heat gun over the affected area. Care must be taken not to leave the hot air in one place for too long, as the surface can become deformed. It is highly recommended that the surface be cleaned with a white cloth moistened with isopropyl alcohol prior to printing.

All screen-printing inks should be tested in a manner which duplicates your printing process before initiating production. It is strongly recommended to consult the appropriate ink manufacturer regarding any required ink additives, such as a catalyst, for proper adhesion and exterior usage. Screen Printing ink should dry in the air, rather than be heat-dried. Temperatures above 150° F may cause the sheet to warp or bow.

Most UV screen-printing inks compatible with rigid PVC will work on BOTOFOAM. The most important factor to be considered when using UV systems is the curing oven. Low-wattage bulbs should be used to keep the temperature below 150° F. UV curing systems with variable-speed conveyors are considered the best option.

Direct Digital Printing

Wide-format and flatbed printers use various inks and ink-curing technologies to allow high-quality printing at relatively high speeds. Both BOTOFOAM EP and BOTOFOAM SP sheets are suitable for use with UV curing and solvent-based digital inks, and for IR drying when water-based inks are used. High-quality digital printing depends on various factors:

- Printer capabilities
- Ink technology and quality
- Type of printing substrate and quality
- Machine operator

Protective Film Masking

The protective polyethylene film mask helps prevent surface abrasion and stains. However, removing the protective film may increase static charge, which can affect ink coverage. Therefore, after peeling the film from the sheet, the static electricity built up on the sheet should be discharged using an ionized gun or a suitable device provided by the printer manufacturer.

Cleaning and Preparing for Printing

The surface should be clean before printing. Carefully inspect each panel to ensure there is no: dust, fingerprints, residue or other problematic substances that may affect ink coverage or adhesion. If needed, the sheet should be cleaned with a damp rag, or with isopropyl alcohol.

Ink

BOTOFOAM EP and BOTOFOAM SP are both suitable for all types of inks: Aqueous, Solvent-Based, and UV-curable. Consult the printer manual or contact the printer manufacturer for recommendations and compatibility information.

Drying the ink

The two main drying technologies are:

IR (Infrared) – Long exposure to high temperature in the drying tunnel may cause distortions in the sheet.

UV (Ultraviolet) – UV levels must be adjusted according to the printing speed and substrate.
UV overexposure can cause discoloration of both the ink and substrate.
UV inks should be curved for 24 hours for best printing ink adhesion.

Print Head Adjustment

The distance between the print head and the substrate can have a significant effect on print quality. Manufacturer specifications, combined with operator experience, should determine print head distance from the substrate. The suggested starting distance should not be more than 2 mm from the print head to the substrate.

Laminating / Mounting

BOTOFOAM PVC Sheet is an ideal material for applications that require lamination. This section provides preparation processes as well as detailed instructions for the various types of laminations that can use. Because prints are one of the most frequently laminated materials, the sections that follow will generally refer to the lamination of a print, although many other materials can be used.

Note: Since PVC material may warp when heated above 150°F or when heated from one side only, it cannot be used in any lamination process requiring heat

Adhesion

For the best results, the BOTOFOAM PVC sheet should be cleaned with isopropyl alcohol before adhesion and allowed to dry thoroughly. When laminating with pressure-sensitive adhesives, a force of 25–40 psi is required. Proper spacers are also critical. Because force must be applied equally across the material, the top roll must move evenly from left to right while maintaining even contact between the top and bottom laminating rolls. To achieve even contact, " zero the nip ", then use spacer shims to preset the nip opening for a particular laminate. Use sufficient pressure to eliminate any air bubbles between the sheet, the adhesive and the print or other material.

The lamination will achieve maximum bonding in three hours. If the lamination has been performed correctly, the finished mount can be flexed without the print becoming loose in the center. To prevent moisture from becoming trapped between layers of porous material (such as paper) and forming blisters, the moisture content of both the material to be laminated and the atmosphere should be reduced before pressing. Some materials may require pre-drying. The sheet itself is nonporous and does not need pre-drying.

Preventing Surface Flaws

Surface blemishes, such as wrinkles, can be caused by misalignment of the adhesive roll, excessive pressure, or rollers that are not parallel. Trapped dirt or lumps of hardened adhesive, common with glossy prints, may create small bumps in the finished product. To prevent these problems, equipment must be kept clean. Use a fresh roll or sheet of transfer adhesive if bumps are caused by hardened adhesive. Dirt problems can be minimized by using an ionizing static eliminator. Using prints or other materials made with paper 0.007" or thicker can help prevent strike-through. For best results, wipe down the back of the print and the face of the sheet mount with a clean, dry cloth before it passes through the roll nip. Whether the finished product is to be used indoors or outdoors, a clear, high-gloss overlay will help protect against fading as well as enhance the color.

Laminating Techniques

Four techniques are recommended for laminating materials to BOTOFOAM, as described in the following sections. Depending on the type of application and the available equipment, one or more of these processes may be appropriate for a particular application. None of these processes involves heat. Because BOTOFOAM may warp at temperatures above 140°F or when heated from one side only, it cannot be dry-mounted or hot-mounted.

- Cold laminating with a press using adhesive-backed paper
- Cold laminating using a vacuum press
- Hand laminating using transfer adhesive
- Hand laminating using spray adhesive

Cold Laminating with a Press using Adhesive-backed Paper

Commercial photo labs most frequently use this process. Either of two types of liner films, a single release liner film or a double release liner film, can be used for this process. The basic process for laminating with a press using adhesive-backed paper is described in the following section.

1. Set the roller pressure properly for the thickness of the pre-coated mounting substrate.
2. Place the mounting substrate on a flat surface and expose approximately one inch of the adhesive by peeling back the releasepaper. Fold back the release paper, making an even crease across the paper.
3. Carefully position the print on top of the substrate, using the folded release paper to prevent contact with the exposed adhesive. Once positioned correctly, carefully apply the print to the exposed adhesive, pressing from the center toward the edges to ensure a smooth tack.
4. Place the direction switch in the forward position and the speed control on medium.
5. Insert the materials to be processed into the laminator opening. Feed the substrate between the rollers until the pressure roller rests on the tacked portion of the material.
6. Hold the un-tacked portion of the print up and against the pressure roller. Feed the substrate through the rollers while peeling the release paper off the mounting substrate with one hand. To prevent wrinkles, the print must be held against the opposite hand while the substrate feeds through the press.
7. Remove the mounted print from the rear of the laminator and trim it to the required size.

Coating using Single Release Liner Films

1. Set the pressure properly for the thickness of the sheet to be processed.
2. Load the supply roll of pressure-sensitive adhesive.
3. Pull approximately 12 inches of adhesive film forward off the roll. Rest the film, adhesive side up, on top of the pressure roller.
4. Create a leader board by cutting a piece of substrate slightly larger than the width of the adhesive film and approximately four to six inches long. Lay the leader board across the adhesive film and smoothly adhere the bottom of the leader to the adhesive.
5. Place the direction switch in the forward position and the speed control on medium.
6. Pull the leader down and push it between the rollers. Feed the leader between the rollers approximately three to four inches. Be sure that the adhesive stays firmly adhered to the leader.

7. Once this process has been completed (referred to as " stringing the web ") and the adhesive is feeding without wrinkles, the laminator is ready for production.
8. To coat, feed a substrate behind the leader board and between the roller while depressing the foot switch. Feed until the substrate exits the rollers and automatically stops feeding. At this time, another substrate may be fed between the rollers for coating. This process is suitable for films with a paper release liner and leaves a 3/8" to 1/2" gap between the coated substrates to facilitate trimming.
9. After exiting the laminator, the coated substrates should be split apart and trimmed.

Coating using Double Release Liner Films

Coating with a double-release liner film requires a take-up mechanism to automatically remove and rewind one of the release liners during the coating process.

1. Set the pressure properly for the thickness of the substrates to be processed.
2. Load the supply roll of pressure-sensitive adhesive.
3. Adhere double-stick tape or a pressure-sensitive adhesive film to the surface of the take-up shaft.
4. Pull approximately 18 inches of adhesive film forward off the roll and adhere one release liner side smoothly to the take-up shaft, taking care to ensure that the film is square with the supply roll and no diagonal wrinkles are apparent.
5. Separate the adhesive film from the release liner secured to the take-up shaft and pull the adhesive film and remaining release liner down so that it rests adhesive side up on top of the pressure roller.
6. Lay a leader board the same thickness as the substrates to be used across the exposed adhesive.

Cold Laminating with a Vacuum Press

This method is suggested for small and medium-sized photo shops for mounting prints utilizing a spray adhesive.

1. Spray the adhesive on the back of the piece to be mounted, keeping the spray six to eight inches from the surface. If using a double coat of adhesive, the second coat should be applied perpendicular to the first. For bonding most art materials, the adhesive is typically applied only to one surface, usually the back of the print.
2. Allow the spray to dry for two to four minutes before mounting so that the adhesive becomes tacky. If blisters form from trapped solvent, allow the adhesive to dry for slightly longer than 4 minutes.
3. Position the print on the PALIGHT material and place it inside the vacuum frame. 4. Apply vacuum for 10 minutes.

Hand Laminating using Transfer Adhesive

For small shops or display makers without access to presses, this method can be used for the lamination of flat, relatively small items utilizing a transfer adhesive.

1. Using a sheet of transfer adhesive having both sides covered by release paper, peel away and fold back the release paper 1/2" inch from one edge.
2. Place the edge of the print to be laminated on the exposed adhesive.
3. Remove the rest of the release paper while lifting the print slightly to avoid contact with the adhesive, then use a roller or a squeegee to smooth the print evenly onto the adhesive.
4. With the print facing down and the remaining release paper facing up, smooth out any excess air from between the print and the adhesive with a squeegee.
5. To laminate the print to the BOTOFOAM, peel away and fold back the release paper 1/2 inch from one edge.
6. Placing the print evenly on the BOTOFOAM, tack the exposed adhesive to the BOTOFOAM.
7. Gradually remove the liner while pressing closely with a hand roller or a squeegee to eliminate any air bubbles until the entire print has been laminated.

Hand Laminating using Spray Adhesive

For small shops or display makers without access to equipment, this method is recommended for the lamination of flat, relatively small items utilizing a spray adhesive.

1. Spray the adhesive on the back of the piece to be mounted, keeping the spray six to eight inches from the surface. If using a double coat of adhesive, the second coat should be applied perpendicular to the first. For bonding most art materials, the adhesive is typically applied only to one surface, preferably the back of the print.

2. Allow the spray to dry between two and four minutes before mounting so that the adhesive becomes tacky.
3. Place the adhesive side of the print or other item on the BOTOFOAM surface, pressing smoothly from the center of the piece to the edges to eliminate any wrinkles and trapped air immediately.
4. Place a clean sheet of BOTOFOAM over the laminated piece to weigh it down. Although the bond should be at maximum strength after fifteen minutes, allow 24 hours before exposing the piece to any sudden temperature or humidity changes.

Delaminating

A print mount can delaminate within 5 minutes if a pressure-sensitive adhesive has been used. Although the print is usually destroyed, the BOTOFOAM can be reused. If five minutes have already passed, a hot-air gun or hair dryer can be used to heat the material to peel off the lamination. Isopropyl alcohol or mineral spirits can be used to remove the remaining adhesive.

Chemical Resistance

The mechanism of chemical attack on thermoplastics, in general and BOTOFOAM PVC sheets in particular, differs significantly from that of metal corrosion. Corrosion of metals results in a gradual loss of surface material due to electrolytic action by the relevant chemicals. A chemical attack on BOTOFOAM PVC sheet generally involves the chemical's absorption into the PVC sheet, followed by swelling. The chemical resistance behavior of BOTOFOAM PVC sheets is, therefore, simple to determine. Chemical resistance is expressed as weight change (usually an increase) and volume change.

The table on the following pages lists the resistance of BOTOFOAM PVC sheets to several commonly encountered chemicals and other corrosive media at room temperature. (Information on chemical resistance at higher temperatures will be supplied upon request). When chemical resistance varies with concentration, results from tests at different concentrations are presented. The information listed is based on long-term laboratory tests and actual service installations. For chemicals or corrosive media not listed, please contact your Boto Plastics representative. He will place you in contact with the Boto Plastics Technical Support Department. It is important to note that BOTOFOAM PVC sheets are generally not recommended for use with acetone, ketones, ethers, and aromatic and chlorinated hydrocarbons.

The information on chemical resistance is based on our research and experience. It serves as a basis for recommendations.

Boto Plastics does not guarantee chemical resistance, unless specific tests are carried out and separate documentation is supplied.

The table on the following page uses the following key:

R Resistant LR Limited Resistance (gradual attack over time may qccur)

N Not Resistant (rapid attack or attack over short time period will occur)

IMPORTANT NOTE: The most up-to-date version of the information below is available on www.botoplastics.com

*concentration for aqueous solution except where noted

Chemical	Concentration %*	Resistance	Chemical	Concentration %*	Resistance
Acetaldehyrde	100	N	Bromobenzene		N
Acetic Acid	80	R	Butadiene		N
Acetic Acid	100	LR	Butane		N
Acetic Anhydride		N	Butyl Acetate		N
Acetone		N	Butyl Alcohol		R
Acrylonitrile		N	Butyl Stearate		R
Acetylene		R	Butyric Acid		N
Ajax		R	Calcium Chloride	Saturated	R
Allyl Alcohol		LR	Calcium Hydroxide		R
Aluminum Chloride	Saturated	R	Calcium Hypochlorite		R
Aluminum Fluoride		R	Calcium Nitrate		R
Aluminum Hydroxide		R	Calcium Sulfate		R
Aluminum Sulfate	Saturated	R	Camphor		R
Ammonia (Gas)		R	Carbon Dioxide Gas (Moist)		R
Ammonia (Liquid)		N	Carbon Disulfide		N
Ammonium Acetate		R	Carbon Monoxide		R
Ammonium Bifluoride		R	Carbon Tetrachloride		N
Ammonium Bisulfate		R	Castor Oil		R
Ammonium Chloride		R	Caustic Potash (Potassium Hydroxide)	50	R
Ammonium Fluroide	25	LR	Caustic Soda (Sodium Hydroxide)	50	R
Ammonium Hydroxide	28	R	Chlorine Dioxide	15	R
Ammonium Nitrate		R	Chlorine Gas (Dry)		N
Ammonium Sulfate	Saturated	R	Chlorine Gas (Wet)		N
Ammonium Sulfate	Saturated	R	Chlorine Water	2	R
Amyl Acetate		N	Chloroacetic Acid		R
Amyl Alcohol	Pure	LR	Chlorobenzene		N
Aniline		N	Chloroform		N
Antimony Trichloride		R	Chrome Alum	Saturated	R
Aqua Regia (3 parts HCl:1 part HNO_3)		N	Chromic Acid	10	R
Arsenic Acid	80	R	Citric Acid	Saturated	R
Barium Chloride		R	Copper Fluoride		R
Barium Hydroxide		R	Copper Nitrate		R
Barium Sulfate		R	Copper Sulfate		R
Barium Sulfate		R	Corn Syrup		R
Beer		R	Cottonseed Oil		R
Beet (Sugar Liquor)		R	Cresol		N
Benzaldehyde		LR	Cresylic Acid	50	R
Benzene		N	Cupric Chloride	Saturated	R
Benzoic Acid		R	Cuprous Chloride	Saturated	R
Benzyl Alcohol		R	Cyclohexane		N
Bleach	12% Chlorine	R	Cyclohexanol		N
Boric Acid		R	Cyclohexanone		N
Brake Fluid		LR	Dextrose		R
Brine		R	Detergent (most)		R
Bromic Acid		R	Diesel Fuel		R
Bromine (Liquid)		N	Diethyl Ether (Ethyl Ether)		R
Bromine (Water)		LR	Dimethyl Amine		N
Bromine (Vapor)	25	R	Dioctyl Phthalate		N

The table on the following page uses the following key:

R Resistant LR Limited Resistance (gradual attack over time may qccur)

N Not Resistant (rapid attack or attack over short time period will occur)

IMPORTANT NOTE: The most up-to-date version of the information below is available on www.botoplastics.com

*concentration for aqueous solution except where noted

Chemical	Concentration %*	Resistance	Chemical	Concentration %*	Resistance
Dioxane		N	Linseed Oil		R
Ethanol (Ethyl Alcohol) and Water	All	R	Lithium Bromide		R
Ethanol (Ethyl Alcohol)	Pure	R	Lubricating Oil		R
Ethyl Acetate		N	Magnesium Carbonate		R
Ethyl Chloride		N	Magnesium Chloride		R
Ethylene Chlorohydrin		N	Magnesium Hydroxide		R
Ethylene Dichloride		N	Magnesium Sulfate		R
Ethylene Glycol		R	Maleic Acid		R
Fatty Acids		R	Malic Acid		R
Ferric Acetate		R	Manganese Chloride		R
Ferric Chloride	Saturated	R	Manganese Sulfate		R
Ferric Hydroxide		R	Mercuric Chloride		R
Ferric Nitrate		R	Mercuric Nitrate		R
Ferric Sulfate		R	Mercuric Sulfate		R
Ferrous Chloride		R	Mercury		R
Ferrous Hydroxide		R	Methanol and Water	All	R
Ferrous Sulfate		R	Methanol (Methyl Alcohol)	Pure	R
Fluorine Gas		LR	Methyl Chloride		N
Fluorine Gas (wet)		R	Methyl Ethyl Ketone (MEK)		N
Fluoroboric Acid		R	Methylmethacrylate		R
Formaldehyde		LR	Methyl Sulfate		LR
Formic Acid		R	Methyl Sulfuric Acid		R
Freon 11, 12, 113, 114		LR	Methylamine		N
Fluosilicic Acid		R	Methylene Bromide		N
Fruit Juices and Pulp		R	Methylene Chloride		N
Gasoline		R	Methylene Chlorobromate		N
Glucose		R	Methylene Iodide		N
Glycerine		R	Milk		R
Heptane		R	Mineral Oil		R
Hexane		N	Motor Oil		R
Hydrazine		N	Naphtha		R
Hydrobromic Acid	20	R	Naphthalene		N
Hydrochloric Acid	35	R	Nickel Chloride		R
Hydrofluoric Acid	70	LR	Nickel Nitrate		R
Hydrogen		R	Nickel Sulfate		R
Hydrogen Peroxide	50	R	Nitric Acid	60	R
Hydrogen Sulfide		R	Nitrobenzene		N
Iodine		N	Nitroglycerine		N
Kerosene		R	Nitrous Oxide	Saturated	R
Ketones		N	Oleic Acid		R
Lactic Acid	20	R	Oxalic Acid		R
Laurel Chloride		R	Oxygen		R
Lead Acetate		R	Ozone		R
Lead Chloride		R	Palmitic Acid	40	R
Lead Nitrate		R	Paracetic Acid	70	LR
Lead Sulfate		R	Perchloric Acid		LR
Linoleic Acid		R	Phenol	85	N
Linoleic Oil		R	Phosphoric Acid		R

The table on the following page uses the following key:

R Resistant LR Limited Resistance (gradual attack over time may qccur)

N Not Resistant (rapid attack or attack over short time period will occur)

IMPORTANT NOTE: The most up-to-date version of the information below is available on www.botoplastics.com

*concentration for aqueous solution except where noted

Chemical	Concentration %*	Resistance	Chemical	Concentration %*	Resistance
Phosphorous (Yellow)		R	Sodium Ferricyanide		R
Phosphorous Pentoxide		R	Sodium Ferrocyanide		R
Phosphorous Trichloride		N	Sodium Fluoride		R
Photographic Chemicals		R	Sodium Hydroxide	50%	R
Picric Acid		N	Sodium Hypochlorite	16% Chlorine	R
Plating Solutions		R	Sodium Nitrate		R
Potassium Bichromate		R	Sodium Nitrite		R
Potassium Bromate		R	Sodium Perchlorate		R
Potassium Bromide	Saturated	R	Sodium Peroxide		R
Potassium Chloride		R	Sodium Sulfate		R
Potassium Chlorate		R	Sodium Sulfide		R
Potassium Chromate		R	Sodium Sulfite		R
Potassium Cyanide		R	Sodium Thiosulfate		R
Potassium Dichromate		R	Stannic Chloride		R
Potassium Ferricyanide		R	Stannous Chloride		R
Potassium Fluoride		R	Stearic Acid		R
Potassium Hydroxide	50	R	Succinic Acid		R
Potassium Nitrate		R	Sugar	Saturated	R
Potassium Perborate		R	Sulfur Dioxide (Dry Gas)		R
Potassium Perchlorate		R	Sulfuric Acid		R(LR)
Potassium Permanganate	10	R	Sulfurous Acid	<80(>80)	R
Potassium Persulfate		R	Tannic Acid		R
Potassium Sulfate		R	Tanning Liquors		R
Propane		R	Tartaric Acid		R
Propyl Alcohol (1Propanol)	100	R	Tetraethyl Lead		R
Propylene Dichloride		N	Tetrahydrofuran		N
Propylene Oxide		N	Tetrasodium Pyrophosphate		R
Pyridene		N	Thionyl Chloride		N
Pyrogallic Acid		R	Titanium Tetrachloride		R
Salad Oil		R	Toluene		N
Salicylic Acid		R	Trichloroacetic Acid		R
Selenic Acid		R	Trichloroethylene		N
Silicic Acid		R	Triethanolamine		R
Silver Cyanide		R	Triethylamine		N
Silver Nitrate		R	Trimethylamine		LR
Silver Sulfate		R	Trisodium Phosphate		R
Sodium Acetate		R	Tuepentine		LR
Sodium Benzoate		R	Urea		R
Sodium Bicarbonate		R	Vasilene		N
Sodium Bichromate		R	Vegetable Oils		R
Sodium Bisulfate		R	Vinegar		R
Sodium Bisulfite		R	Vinyl Acetate		N
Sodium Carbonate		R	Water (Demineralized or Sea)		R
Sodium Chlorate		R	Wine or Whiskey		R
Sodium Chloride		R	Xylene		N
Sodium Chlorite		N	Zinc Chloride		R
Sodium Cyanide		R	Zinc Nitrate		R
Sodium Dichromate		R	Zinc Sulfate		R

Recommended Uses and Restrictions

Please consult the relevant product and / or application information for this product within this guide, or in other related sales literature.

Further Information

Additional information on this product may be obtained by calling your Boto Plastics Sales or Customer Service Contact.

Physical Properties

Property*	Conditions*	ASTM Method	Units*	Value* - 5mm Sheet	Value* - 10mm Sheet
Physical					
Water absorption	23°C	D-570	%	0.8	0.8
Density			g/cm^3	0.53-0.57	0.53-0.57
Mechanical					
Tensile strength at yield	10mm/min		MPa	11	10
Elongation at break	10mm/min	D-638	%	22	17
Flexural strength at yield	10mm/min	D-790	MPa	18	20
Flexural modulus	10mm/min	D-790	MPa	860	800
Impact strength notch charpy	23°C	D-256	J/m	28	15
Thermal					
Service temperature			°C	-10 to 55	-10 to 55
Heat deflection temperature		D-648	°C	60	60
VICAT softening temperature		D-1525	°C	71	71
Coefhcient of linear thermal expansion	Load: 11Kg	D-696	mm/m.k	0.03	0.03
Thermal conductivity		C-177	W/mk	0.07	0.07

BOTO PLASTICS CO., LTD

Unit 603, No 38 West Xinyang Road, Guangzhou 510530 China
Phone: +86 20 2816 8611 Email: info@botoplastics.com
Website: www.botoplastics.com

China Factory
Yiyuan Economic Development Zone Zibo city,
Shandong Province China

Malaysia Factory
Jalan FZ 2-P8, Port Klang Free Zone, 42920 Pulau
Indah, Selangor, Malaysia