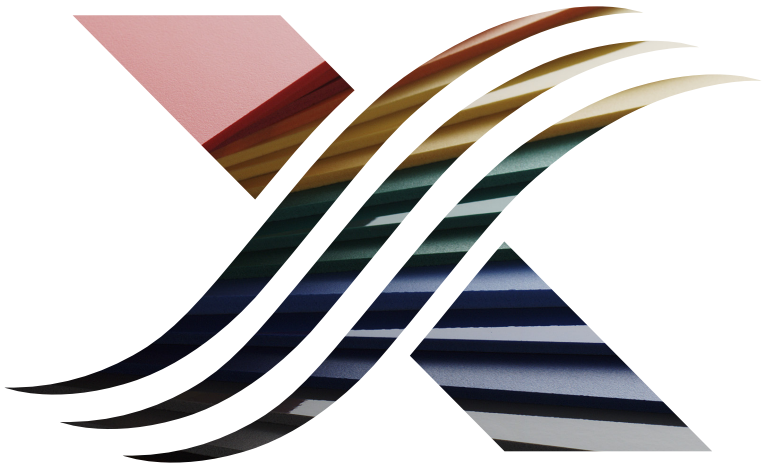
BRETT MARTIN

Plastic Sheets



# foamalux

## FOAM PVC SHEET

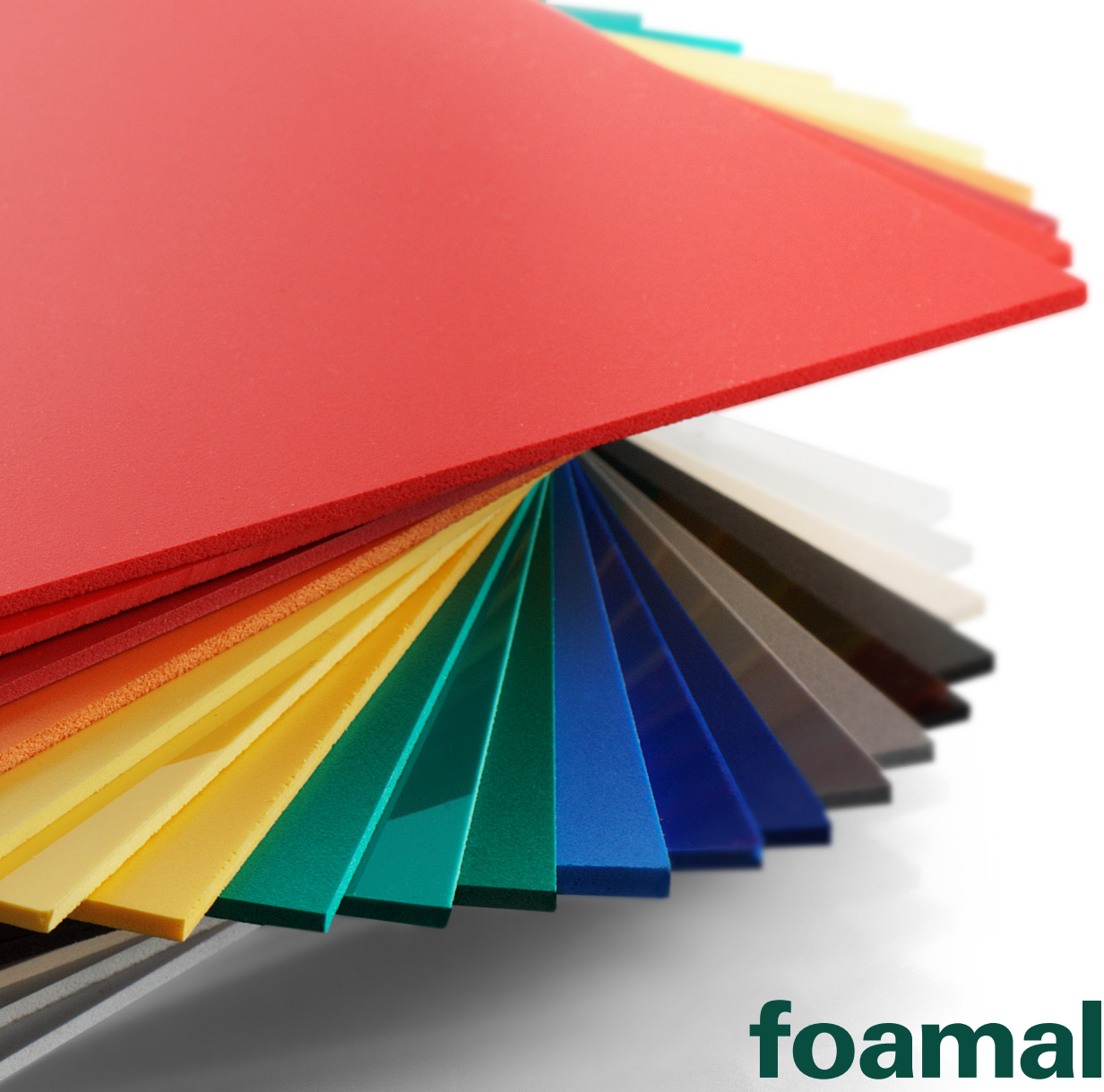
Product Guide

foamalux COLOUR COLOURED FOAM PVC

foamalux ULTRA GLOSS FOAM PVC

foamalux WHITE BRIGHT WHITE FOAM PVC

foamalux XTRA RECYCLED FOAM PVC



foamalux
FOAM PVC SHEET

# Product Guide

Brett Martin is recognised around the world for the manufacture of a wide range of plastic sheet materials ideally suited for construction, engineering, print and display and a comprehensive range of building products and materials. The established brand portfolio includes extensive sheeting, glazing and rooflight options in Polycarbonate, Acrylic, PVC, Foam PVC, aPET, PETg, SAN and Styrene and is continually extended and developed to include new product innovations.

With over 50 years of manufacturing experience and a renowned reputation for excellence Brett Martin export to five continents and over 70 countries affirming a commitment to innovation, product quality, performance and customer service.

foamalux
FOAM PVC SHEET

# Contents


**1. General Overview** Page

Brett Martin 5
Foamalux White 6
Foamalux Colour 6
Foamalux Ultra 6
Foamalux Xtra 6

**2. Application Areas**

Design Versatility 9

**3. Specification & Performance**

Material Properties 11
Fire Rating 11

**4. Packaging & Storage**

Surface Protection 13
Storage & Handling 13
Safety 13
Disposal/Recycling 14

**5. Fabrication Techniques**

Cutting 16
Guillotining 16
Die Cutting 16
Computer Controlled Cutting 16
Sawing 16
Drilling 17
Milling & Routing (Cnc) 17
Stamping 18
Finishing 18

**6. Forming**

Component Geometry 20
Cold Bending 20
Folding 21
Drape Forming 22
Thermoforming 22

**7. Welding**

Hot Plate And Hot Air Welding 25

**8. Mechanical Fixing/ Bonding**

Structures And Frames 28
Panel Orientation 28
Mechanical Fastening 29
Screw Joints 29
Nail/Rivet Joint 30
Bolt Fixing 30
Hole, Slot And Washer Size 31

**9. Bonding/Lamination**

Adhesive Bonding 33
Adhesive Films/Vinyls 34
Vinyl Graphics 34
Lamination 34
Mounting Photographs/Prints 34

**10. Printing & Painting** Page

Surface Preparation 36
Printing 36
Screen Printing 36
Digital Printing 36
Static 37
Reducing Static Electricity 37
Painting/Varnishing 38

**11. Finishing**

Decorative Finishes 40
Edge Finishing 40

**12. Design Factors**

Thermal Expansion 42
Thermal Insulation 42

**13. Application Factors**

Uv Stability 45
Exterior Signage 45
Wind Loading 45
Precipitation 45
Sound Insulation 45

**14. Cleaning & Maintenance**

Safety 47
Cleaning 47
Chemical Resistance 47

**15. Important Notes**

Environmental Policy 49
Responsibility Of End User 49

**Appendices**

Appendix 1 Thermal Expansion Calculation 51
Appendix 2 Chemical Resistance 53
Appendix 3 Adhesives Manufacturers 57


**IMPORTANT NOTE ON SEMI-FINISHED MATERIALS**

Since the end uses of semi finished materials are so diverse it is the responsibilty of each user of Brett Martin's Foam PVC Sheets to make his own tests to determine the material's suitability for his own particular use.

All the information is given in good faith but without commitment and warranty given or implied. Brett Martin accepts no liability for defects, loss or damage resulting from misuse, improper installation, inappropriate specification or any other factor beyond its control.

In accordance with our company's policy of continual product development, you are advised to check with your local Brett Martin representative to ensure that you have obtained the most up to date information.

foamalux
FOAM PVC SHEET

# Section 1
## General Overview


| General overview | Page |
|---|---|
| Brett martin | 5 |
| Foamalux white | 6 |
| Foamalux colour | 6 |
| Foamalux ultra | 6 |
| Foamalux xtra | 6 |

# General overview

Brett Martin is a leading international manufacturer of a range of sign and display substrates that works in partnership with a world-wide network of distributors to supply the versatile and durable Foamalux range.

Foamalux is one of the leading brands of rigid foam PVC sheet. Light in weight, versatile and durable, Foamalux has earned a reputation for quality performance and endless applications in sign, display and print due to its smooth finish, excellent fire performance and easy workability. It provides a flawless surface for different types of printing and mounting and combined with its wide range of colours, Foamalux is the ideal product to fabricate into an endless range of possibilities including displays, exhibitions, point of sale, signs and in-store fittings and graphics.

With bright white, matt and gloss colours and an environmentally friendly option, the Foamalux range offers 4 different products: Foamalux White, Foamalux Colour, Foamalux Ultra and Foamalux Xtra.

**Foamalux White** – an extruded closed cell, unplasticised PVC foam with a dazzling brighter whiter surface ideal printing;

**Foamalux Colour** – an extruded closed cell, unplasticised PVC Foam sheet in a vibrant palette of 15 colours;

**Foamalux Ultra** – a co-extruded closed cell, unplasticised PVC foam with a high gloss solid PVC top surface providing an enhanced weatherable surface finish in white and 6 dynamic colours;

**Foamalux Xtra** – a co-extruded closed cell, unplasticised PVC foam with a black recycled core, developed to utilize re-cycled PVC within a high quality sheet. Foamalux Xtra S2 consists of a black recycled core sandwiched between two smooth surfaces of virgin material, Foamalux Xtra S1has one co-extruded white surface layer of Foamalux virgin material.

Foamalux Foam PVC, as with all Brett Martin products, is manufactured to the highest standards of excellence which have earned Brett Martin BSI Registered status under BS EN ISO 9001. Production controls and specified tolerances ensure uniformity of surface finish, thickness, colour, cell structure and density across the Foamalux ranges and tight tolerances on all these parameters.

Foamalux products do not contain any of the six substances covered by ROSH (Restriction of use of Hazardous Substances in Electrical and Electronic Equipment: Directive 2011/65/EC)

All rigid Foam PVC and associated packaging are compliant with REACH Directive EC 1907/2006.

**The products in the Foamalux range have very similar characteristics and are therefore dealt with together throughout this product guide, any differences being highlighted within the relevant section.**

# Product range

## FOAMALUX WHITE

Extensive research into colour pigmentation has led to the development of a brighter white colour formulation throughout the Foamalux range which optimises graphical reproduction capabilities and UV stability to achieve outstanding print clarity and quality. The finely balanced blend of pigments in Foamalux White provides a perfectly clean, crisp printing surface resulting in a noticeably brighter and truer print finish, achieving optimum print clarity of the highest quality. Foamalux White also provides an ideal bright white surface for traditional sign and display applications.

### Options

### Foamalux White Sizes

| | White |
|---|---|
| 1220 x 2440 | 1, 2, 3, 4, 5, 6, 8, 10, 13 & 19mm |
| 1220 x 3050 | 2, 3, 5 & 10mm |
| 1560 x 3050 | 2, 3, 4, 5, 6, 8, 10 & 19mm |
| 2050 x 3050 | 2, 3, 4, 5, 6, 8 & 10mm |

*Non Standard thickness available on request

## FOAMALUX COLOUR

The depth and intensity of colour combines with the ultimate silky smooth matt surface finish to make Foamalux Colour the best coloured Foam PVC sheet on the market. Available in a choice of 15 colours as standard, Foamalux Colour provides the ultimate palette available for sign, print and display.

### Foamalux Colour Sizes

| | |
|---|---|
| 1220 x 2440 | 3 & 5mm |
| 2050 x 3050 | 3 & 5mm |

### Colours

- Strawberry Red
- Red
- Orange
- Sunburst Yellow
- Yellow
- Green
- Blue
- Light Blue
- Grey
- Black
- Ivory
- White

### Limited Edition Sizes

| | |
|---|---|
| 2050 x 3050 | 3mm |

### Limited Edition Colours

- Neon Pink
- Neon Green
- Raspberry
- Black Sparkle

## FOAMALUX ULTRA

Foamalux Ultra is a strong and durable rigid foam PVC sheet with a high gloss finish. The co-extruded gloss surface gives improved UV protection and stability over standard foam PVC for external applications. Foamalux Ultra is available in white plus 6 deep intense colours.

### Foamalux Ultra Sizes

| | White | Colour |
|---|---|---|
| 1220 x 2440 | 3 & 5mm | 3 & 5mm |
| 1220 x 3050 | 3 & 5mm | - |

### Colours

- Red
- Yellow
- Green
- Blue
- Grey
- Black
- White

## FOAMALUX XTRA

Make a greener choice with Foamalux Xtra, the environmental range of Foam PVC. Manufactured from recycled foam PVC recovered from production and post consumer waste, Foamalux Xtra Foam PVC is the green alternative. Foamalux Xtra comprises of a recycled black core, co-extruded with one or two surfaces of premium quality virgin white PVC, providing the optimum surface for any sign and display applications. Containing up to 80% recycled content Foamalux Xtra is the environmentally friendly sign and display solution.

foamalux
FOAM PVC SHEET

## Options

| | |
|---|---|
| S1 - Single sided bright white surface with recycled black underside | |
| 1220 x 2440 | 3mm & 5mm |
| 1220 x 3050 | 3mm & 5mm |
| S2 - Double sided bright white surface with recycled black core | |
| 1220 x 2440 | 10mm & 13mm |
| 1220 x 3050 | 10mm |
| 1220 x 4050 | 10mm |
| 1560 x 3050 | 10mm & 19mm |
| 1560 x 4050 | 10mm |

| COLOUR CHART | | | | |
|---|---|---|---|---|
| COLOUR | PANTONE* | | RAL* | |
| | Lighter | Darker | Lighter | Darker |
| Strawberry Red | 193C | 195C | 3014 | 3003 |
| Red | 1788C | 1795C | 3018 | 3020 |
| Orange | 150C | 152C | 2003 | 2008 |
| Sunburst Yellow | 135C | 137C | 1023 | 1028 |
| Yellow | 1215C | 1235C | 1018 | 1021 |
| Green | 355C | 356C | 6018 | 6024 |
| Blue | 299C | 301C | 5015 | 5010 |
| Light Blue | 284C | 285C | 5012 | 5017 |
| Grey | 7C | 9C | 7001 | 7000 |
| Black | 7546C | 7547C | 7021 | 9005 |
| Ivory | 7506C | 7508C | 9001 | 1015 |
| White | | | 9003 | |
| Neon Pink | 1775C | 1785C | 450-1 | 3024 |
| Neon Green | 386C | 388C | 250-1 | 250-2 |
| Raspberry | 220C | 222C | 4003 | 4004 |
| Black Sparkle | | | 820-M | 790-M |

*Pantone and RAL references are approximate colour matches for guidance purposes only

foamalux
FOAM PVC SHEET

# Section 2

## Application Areas


| **Application Areas** | **Page** |
| --- | --- |
| Design Versatility | **9** |

# Application areas

## DESIGN VERSATILITY

The Foamalux product range offers a choice of a full palette of colours plus white, in a satin or a high gloss durable finish. The material can be exploited in many ways and used to produce stimulating signs, displays, in-store graphics and merchandising and endless fabrication possibilities.

Foamalux is ideal for use in a wide variety of indoor and short term outdoor applications, such as:

| Signage and Display | | Wall Cladding | Partitioning | Fabrication | Furniture |
|---|---|---|---|---|---|
| Shop outfitting | In-store graphics and merchandising | Wall cladding | False ceilings | Models | Shelving |
| Portable display | Signs and Sign Lettering | Temporary partitioning | Containers | Containers | Drawer |
| Exhibition stands and systems | Direct digital printing | Linings | | Vacuum formed shapes | Furniture components |
| Custom Displays | Vinyl application and photographic mounting | Insulation sandwich panels | | Fabrication into ducts | Chair Backs |
| Signage – temporary and permanent | Screen printing | Decorative panels | | Equipment covers | Bird Houses |
| Point of purchase/sale | | | | Enclosures | |

FEATURES

| Characteristic | Foamalux White | Foamalux Colour | Foamalux Xtra | Foamalux Ultra |
|---|---|---|---|---|
| Bright white surface | ✔ | | | ✔ |
| Extensive range of colours | | ✔ | ✔ | |
| Satin finish | ✔ | ✔ | | ✔ |
| Gloss finish | | | ✔ | |
| Smooth even surface | ✔ | ✔ | ✔ | ✔ |
| Hard and resilient | | | ✔ | |
| Ideal for printing | ✔ | ✔ | ✔ | ✔ |
| Superb output quality | ✔ | ✔ | ✔ | ✔ |
| Excellent vinyl adhesion | ✔ | ✔ | ✔ | ✔ |
| Easily fabricated | ✔ | ✔ | ✔ | ✔ |
| Engraving opportunities | | | | ✔ |
| Recycled content | | | | ✔ |
| Suitable for exterior applications* | | | ✔ | |

*See Section 13 UV stability / Exterior signage on p. 45

**The range is expanding to meet market demands and alternative options may be available subject to minimum order quantities. Please consult a member of the Brett Martin sales team for up to date range information.**

foamalux
FOAM PVC SHEET

# Section 3
## Specification & Performance


| **Specification & Performance** | **Page** |
|---|---|
| Material Properties | **11** |
| Fire Rating | **11** |

foamalux
FOAM PVC SHEET

# Specification & Performance

## MATERIAL PROPERTIES

The properties listed are typical values obtained by testing large numbers of specimens under specified conditions and procedures. As additional processing of the sheet can influence the material properties, the information given should be treated with caution when applied to finished products

## FIRE RATING

Foamalux PVC is a self-extinguishing material and complies with the most demanding international fire test standards. Contact the technical department for the most up to date certification.

### PHYSICAL CHARACTERISTICS

| Characteristic | Foamalux |
|---|---|
| Base polymer: | Polyvinyl Chloride (PVC) |
| Form: | Unplasticised rigid foam PVC sheet |
| Smell: | Odourless |
| Moisture absorption after 24hrs @ 23°C: | <0.25% by weight |
| Water solubility: | Insoluble |
| Oxygen index: | 48% |

| Characteristic | Foamalux White | Foamalux Colour | Foamalux Xtra | Foamalux Ultra |
|---|---|---|---|---|
| Tensile strength at yield: | 16MPa | 16MPa | 16MPa | 16MPa |
| Modulus of elasticity: | 0.85-0.9MPa | 0.85-0.9MPa | 0.85-0.9MPa | 0.85-0.9MPa |
| Elongation at break: | 27-29% | 27-29% | 27-29% | 27-29% |
| Flexural strength: | 25-27MPa | 25-27MPa | 25-27MPa | 25-27MPa |
| Impact resistance: (Charpy test, un-notched specimen) | 15kJ/m$^2$ | 15kJ/m$^2$ | 15kJ/m$^2$ | TEST |
| Average Sheet Hardness: | > 30 Shore D | > 30 Shore D | > 30 Shore D | > 30 Shore D |

### THERMAL PROPERTIES

| Property | | Value |
|---|---|---|
| Vicat softening temperature: | | 73-76°C |
| Thermal expansion coefficient: | | 0.068 mm/m°C |
| Service temperature range: | | -20 to +60°C |
| Thermal conductivity K: | | 0.085 W/m°C |
| Thermal decomposition temperature: | | >200°C |
| Thermal resistance R: | 1mm | 0.18 m$^2$°K/W |
| | 2mm | 0.19 m$^2$°K/W |
| | 3mm | 0.20 m$^2$°K/W |
| | 4mm | 0.22 m$^2$°K/W |
| | 5mm | 0.23 m$^2$°K/W |
| | 6mm | 0.24 m$^2$°K/W |
| | 8mm | 0.26 m$^2$°K/W |
| | 10mm | 0.29 m$^2$°K/W |
| | 13mm | 0.31 m$^2$°K/W |
| | 19mm | 0.38 m$^2$°K/W |

### ELECTRICAL PROPERTIES

| Property | Value |
|---|---|
| Dielectric Strength | ≈100 kV/cm |
| Surface Resistance | >10$^{12}$Ω |
| Volume Resistivity | 4 x 10$^{15}$Ωcm |
| Dielectric Constant | 2.4 (for 1kHz) |
| Dielectric Dissipation Factor | 0.013 (for 1kHz) |
| Tracking Resistance | 600 CPI |

foamalux
FOAM PVC SHEET

# Section 4
## Packaging & Storage


| Packaging & Storage | Page |
|---|---|
| Surface protection | 13 |
| Storage & handling | 13 |
| Safety | 14 |
| Disposal/recycling | 14 |

# Packaging & Storage

## SURFACE PROTECTION

All Foamalux sheets are covered by a protective polyethylene film. This surface protection is applied to one side of the sheet only and can be removed easily.

All Foamalux sheets are stacked on pallets at the end of the production line. The pallets are covered with stretch-wrap film and strapped to ensure they are received by the end user in pristine condition. The sheets should be similarly protected or packaged at all stages of process to ensure the quality of finished items.

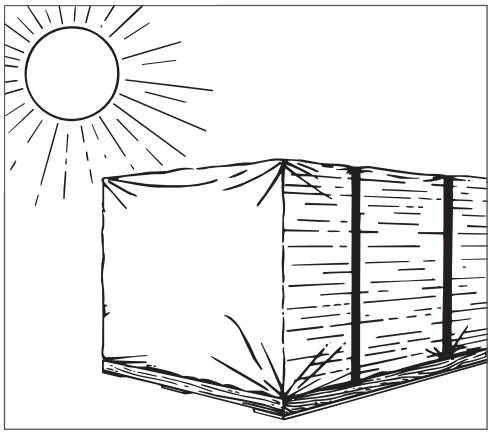
## STORAGE & HANDLING

Foamalux sheets are best stored indoors, away from direct sunlight, in a cool dry store under ambient conditions.

The temperature of uncovered stacked sheets in direct sunlight can rise to levels which will be detrimental to the material: the presence of moisture between sheets can add to damage. Coloured sheets should be stored in their protective cardboard sleeves. **Do not store indoors close to heat sources, for example, radiant heaters or boilers.**

Sheets, whether stored indoors or outdoors, should be laid horizontally on a flat clean surface, for example, a solid topped pallet or wooden sheet raised from the floor or ground. Under the total weight of sheet loaded on to it, this support must not distort, or distortion of the sheet could occur during longer storage periods. Standing sheets on ends or sides, even for short periods, should be avoided.

Where storage outdoors cannot be avoided, at all times the stack of sheets should be completely enclosed within a reflective waterproof cover, placed over wooden battens on top of the stack to avoid contact with the sheet surface. The cover should be secured to protect the stack against sun, wind and rain and the stack should be ventilated to avoid heat build-up.



SURFACE TEMPERATURE
IN DIRECT SUNLIGHT

| Surface Colour | Typical Temperature (°C) |
|---|---|
| Black | 80 |
| Dark Blue | 68 |
| Grey | 67 |
| Red | 68 |
| Green | 70 |
| Yellow | 57 |
| White | 40 |

Foamalux is a relatively flexible material but, if lifted or carried incorrectly, sheets can be stressed beyond their flexible limits and cracked. Sheets and cut panels should not be dragged off a stack but lifted up directly and set down directly. Surfaces on which sheets are set must be clean to avoid damage.

When carrying, sheets should be turned on edge and held top and bottom. It will require more than one person to carry a large sheet or panel. Particular care should be taken with panels which have been processed, for example, screen printed.

## SAFETY

Foamalux is a rigid foam PVC sheet extruded from polyvinyl chloride. It is not subject to the laws governing the use of dangerous materials or chemicals and meets the requirements of the RoHS and WEEE directives of the European Union on the restriction of certain hazardous substances.

No special protective measures are needed when transporting or handling the material. When working with the material care must be taken to protect eyes and avoid inhalation of dust. Foamalux sheets do not constitute fire, explosion or toxic hazard material. In case of a fire involving Foamalux or any other PVC material, water, foam and carbon dioxide extinguishers may be used.

Burning causes noxious fumes to be released e.g. hydrochloric acid, carbon monoxide. Do not breathe decomposition products. When decomposition products have been accidentally inhaled, medical assistance is required.

## DISPOSAL/RECYCLING

Foamalux is a valuable thermoplastic that should be recycled whenever possible.

Sheets which have been mechanically damaged, but have been kept free of contamination by dust or dirt, may be recycled into lower grade PVC products. The appropriate disposal route is through a specialist plastic recycling contractor.

Sheets which have been contaminated by dust, dirt or other materials which cannot be totally removed are generally not suitable for recycling. These should be disposed of in landfill. PVC in landfill is inert and benign in terms of its environmental impact. It will not degrade to any products or by-products that would contribute to soil or water contamination.

PVC must only be incinerated under approved conditions. Foamalux Foam PVC according to industry standards falls within the remit of Category 3.

foamalux
FOAM PVC SHEET

# Section 5
## Fabrication Techniques


| Fabrication Techniques | Page |
|---|---|
| Cutting | 16 |
| Guillotining | 16 |
| Die cutting | 16 |
| Computer controlled cutting | 16 |
| Sawing | 16 |
| Drilling | 17 |
| Milling & routing (cnc) | 17 |
| Stamping | 18 |
| Finishing | 18 |

# Fabrication Techniques

Foamalux is an easy material to work with, using basic wood and metal working tools. When working with any power tool, the sheet temperatures must be kept below the material softening point of 70°C. PVC is a thermoplastic and excessive heat build-up can result in deformation, softening and surface deterioration or discolouration of the sheet substrate. Compressed air is a suitable and easy to apply coolant.

Efficient removal of dust and swarf from the cutting tool helps to lower temperatures. These measures assist in obtaining a good quality cut finish. In general, machining operations require a combination of low feed speed and depth of cut together with a high cutting speed. Correct tool geometry is also important. The recommendations given for tool geometries and speeds should be used as a guide: some experimenting may be required to obtain best results. It is necessary to have an effective means of removing dust produced by machining operations from the operator's environment.

## CUTTING

Different means of cutting are appropriate for various thicknesses, ranging from hand tools to power saws. Preheated sheets are easiest to cut; several light cuts give a better result than one single firm cut.

- Sheets 1- 2mm thick can be cut with shears;
- Sheets 1-3mm thick can be cut with a craft knife;
- Sheet exceeding 3mm in thickness should be sawn.

## GUILLOTINING

Guillotines can be used for rough cutting but are not usually employed to finish-cut as their action compresses the sheet and can give a poor edge finish e.g. permanent edge distortion: cracks can also be initiated in cold sheets. Guillotines with blades heated to around 160°C give a good quality cut edge with less possibility of compressing or otherwise damaging the sheet edge.

## DIE CUTTING

Flat shapes with complex outlines can be die cut from thinner sheets - up to 4mm thick – using sharp, accurately set, steel rule dies: best results are obtainable by preheating sheets to a maximum of 35°C to prevent fracturing the edges. Cut shapes should be placed between flat metal plates to cool, avoiding distortion.

When designing components to be die cut, narrow sections and radii less than 3mm should be avoided. Sheets thicker than 4mm can be die cut provided they are preheated and component radii are at least equal to sheet thickness. Edge finishing may be required.

## COMPUTER CONTROLLED CUTTING

Water-jet cutting is suitable for use in conjunction with Foamalux sheets. Laser cutting is not recommended for use in conjunction with Foamalux PVC sheets due to the excessive heat build up.

## SAWING

Safety First

Due to the high rotational speeds it is very important that:

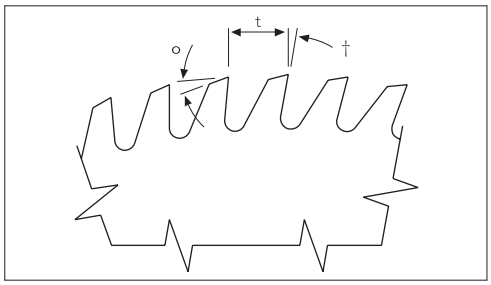
- all protective devices are in good working order and that they are being used;
- all prescribed personal safety equipment is being worn at all times.

Blades designed for cutting plastics are ideal for cutting Foamalux, as are most types of wood saws – band, bench, circular, hand, jig and wall saws. Blades must be sharp, with a slight side set.

Hold and support sheets to avoid stress and vibration, particularly in cold conditions. Blunt blades and very fine tooth metal cutting blades, or incorrectly held material, produce an unsatisfactory finish.

Blades should always cut down into the gloss surface of Foamalux Ultra. When using power saws, clear swarf and avoid heat build up at the cut to produce clean cuts.

A good quality cut can be obtained using both band and circular saws, see below for guidelines of pitch, clearance angle and feed speed.

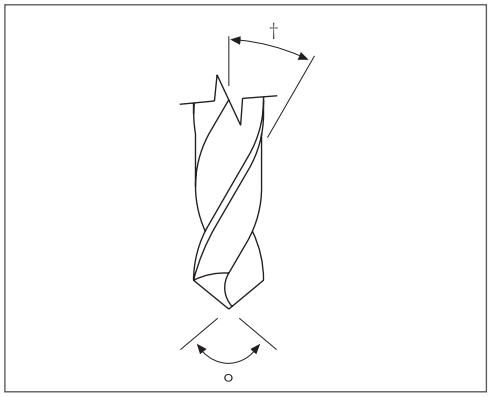



| | |
|---|---|
| Angle o | 10°-15° circular saw<br>30°-40° band saw |
| Rake angle † | 0-8° |
| Tooth pitch t | 5-15mm circular saw<br>2-8mm band saw |
| Circumference speed | 1000-3000m/min. |
| Feed speed | 6-30m/min. |

## DRILLING

The required sheet thickness and hole diameter determine the appropriate drill type. It is more difficult to drill large holes in thinner sheets than small holes in thicker sheets. Thin sheets require a high drill speed and low feed speed. Slower feed speeds are used in deeper holes to minimize heat build up. Do not use liquid cooling to prevent overheating when drilling deep holes it is recommended to regularly withdraw the drill bit.

Standard twist bits for metal are suitable for holes up to 12mm diameter in all thicknesses; good results can be obtained with a point of between 80-1100 and helix angle of 10-300. Holes over 12mm in diameter can be drilled with flat bits, normally used for drilling wood. Above 25mm diameter it is necessary to use hole saws or circular cutters.



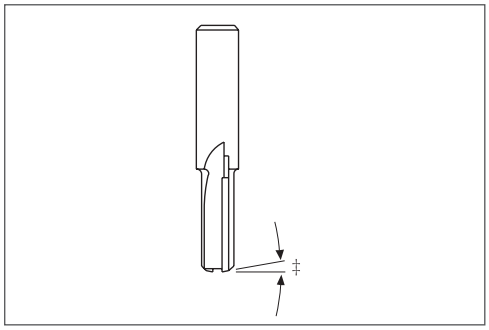

| | |
|---|---|
| Tip angle o | 100° - 110° |
| Helix angle † | 30° |
| Drill speed | 1000 - 3000 rpm |
| Feed speed | 0.2 - 0.5mm /rev. |

| Hole size | Recommended drill type |
|---|---|
| <12mm | Standard twist bits |
| 12 – 25mm | Flat bits, used for drilling wood |
| >25mm | Hole saws or circular cutters |

## MILLING & ROUTING (CNC)

All types of milling machines and routers can be used to machine Foamalux if suitable tool geometry and cutting conditions are used. Vacuum clamping machines are ideal as they are less likely to mark the surface than mechanical clamping. Where sheets are mechanically clamped, load spreading pads should be used to avoid surface marks. Depth milling will remove the smooth surface to reveal a matt closed cell structure.

Cutting tools must be capable of clearing large quantities of chips and cut depths and feed speeds must not be too high to avoid heat build up and poor edge finish. Cutters with single or twin cutting edges are most suitable.




| | |
|---|---|
| Relief angle ‡ | 0-15° |
| Cutting speed | up to 18000 rpm |
| Feed speed | 0.3-0.5mm /rev. |

## STAMPING

Foamalux can be stamped out but this is usually limited to thinner sheets and deformation of the cut edges may be observed. The material temperature should be approximately 20-30ºC to obtain the best edge finish.

## FINISHING

Sheet edges can be finished by filing, sanding, grinding, planing or using a deburring tool, for example, a flat steel edge scraper. Such finishing operations on the sheet surfaces will expose the inner cell structure which might be undesirable in some applications. Glossy surface finishes can be obtained using soft buffing wheels and applying polishing compound, but avoid abrading the surface. For more information on edge finishing, see section 11, page 40.

foamalux
FOAM PVC SHEET

# Section 6
# Forming


| Forming | Page |
|---|---|
| Component geometry | 20 |
| Cold bending | 20 |
| Folding | 21 |
| Drape forming | 22 |
| Thermoforming | 22 |

# Forming

Many processing operations involve heating. Foamalux is a thermoplastic material which attains an elastic state and is therefore formable at material temperatures in the range 115-135°C. The panel to be shaped or formed requires even heating throughout its area and thickness. The component formed in the elastic state, when cooled slowly to a rigid state in the forming device, retains the formed shape.

As Foamalux is a cellular material it is not suitable for forming operations which involve excessive stretching in the elastic state. When applying localized heating care should be taken to avoid overheating that could cause permanent deformation or material degradation. Excessive temperatures and the application of pressure may result in the rupture of the cells and blemishing of the external surface.

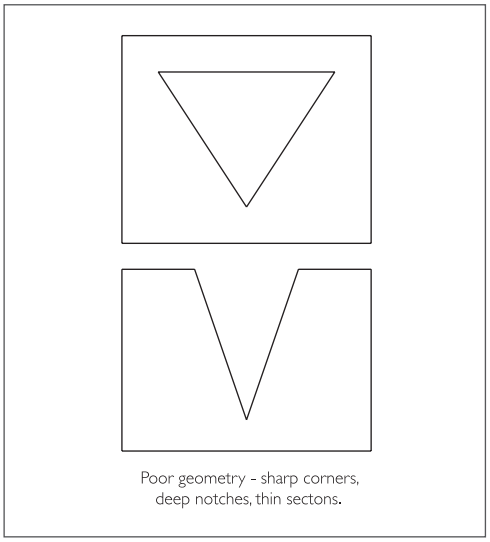
Foamalux sheets are anisotropic which means the properties of the sheet vary depending on the manufacturing direction. Like wood, which is easier to split along its grain than across its grain, Foamalux sheets should always be bent across the manufacturing direction to reduce the risk of breakage.

It is essential to ensure that all panels are free from dust, oil and any other contaminants prior to any forming operation, as these will detract from the quality of the finished product.

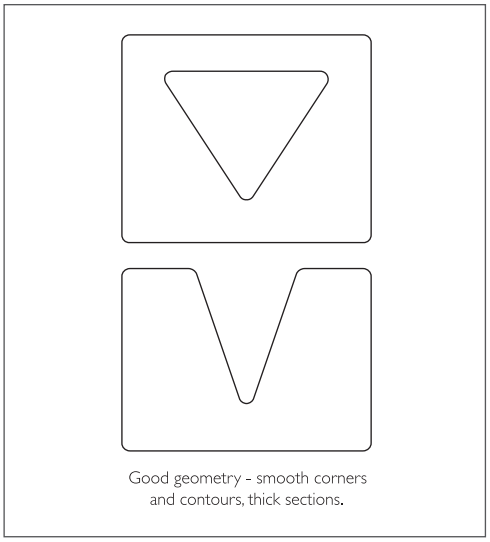
## COMPONENT GEOMETRY

Sharp corners and notches in thermoplastic components assist in the initiation and propagation of cracks, particularly if a component is under stress. Creases, grooves and sharp bends also form potential weaknesses. Component shapes should exclude such features; all internal and external corners or changes in direction should follow a smooth radius profile.

Where designs involve hot bending of sheets, radii should ideally be not less than two and half times and sheet thickness.



Poor geometry - sharp corners, deep notches, thin sectons.



Good geometry - smooth corners and contours, thick sections.

## COLD BENDING

Sheets up to 6mm can be cold bent into basic shapes. The recommended temperature for cold bending is at least 20°C, preferably higher. The minimum bending radius is approximately 100 times the thickness of the sheet, for example 300mm for a 3mm sheet.

In order to cold bend sheets >6mm, parallel kefts along length can be cut using a horizontal panel saw It's best to use a pitch equal to the width of the saw blade in a sheet whilst leaving 1 to 2mm of the material.

## FOLDING

Care should be taken when folding due to stressing and cracking of sheets. Prior to folding, localized strip heating to about 130°C is required. Heat the material for a distance equivalent to three times the sheet thickness on each side of the fold centre line.

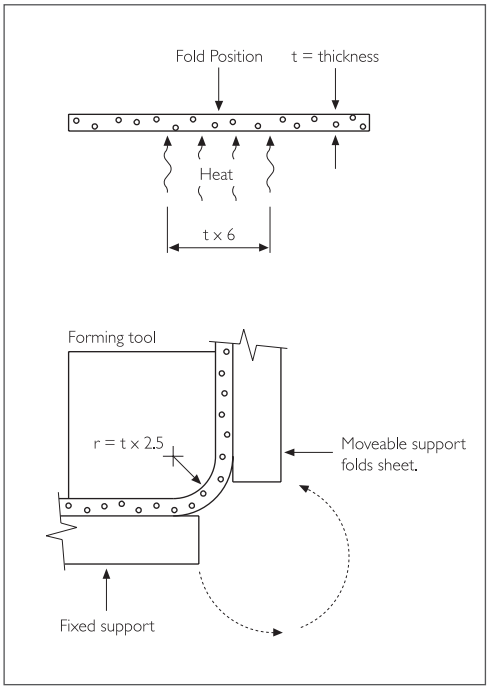
Heat sources such as hot air blowers, hot gas welders, hot air circulating ovens and infra-red panel heaters can be used in conjunction with Foamalux products. All require controls which enable good regulation of their temperature and that of the Foamalux sheet.

When heating is complete and the required shape produced, it must be allowed to cool on the forming equipment before handling or further processing, to avoid warping. Foamalux can be folded on a simple jig, fitted with a forming tool having a radius of about two and a half times the sheet thickness. Note:  The material is not suitable for cold folding as it will stress and crack.

For radiant heat applications, a heating time of 20 seconds for each 1mm of sheet thickness is a reasonable starting point. For oven heating applications, this increases to 40 seconds per 1mm of sheet.

Heating of one side will usually be enough for sheets up to 3mm thick. Above this thickness heat should be applied to both sides, reducing heating times and the possibility of surface damage.

Some experimentation will always be required to obtain optimum temperatures for forming, these being a function of sheet thickness and the specific forming operation. Sheet colour and atmospheric conditions also have some influence.




When using Electrical Heated Metal Tracks, the following guidelines should be adhered to:

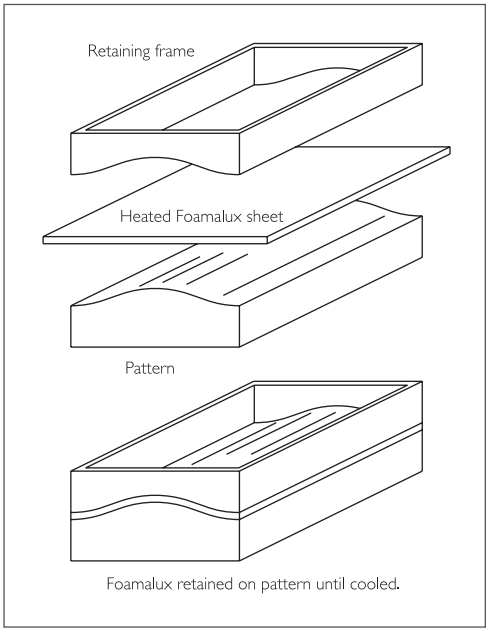
- Maintain metal tracks at a temperature of 140-160ºC.
- Up to 4mm sheet can be heated on one side; 5mm or thicker sheet require heating on both sides.
- Keep heating time at approximately 50-60 seconds per mm of sheet thicknesses.

Hot Air Welding Guns can be used for small areas of sheet to be folded whilst Controlled Hot Air Blowers provide localised heating used for mobile assembly work.

Prior to bending thicker Foamalux sheets (8mm or above) it's important that any excess material at the inside of the bend is removed. This can be achieved by milling out a V groove. It is recommended to mill the V groove 10 wider than the desired bending angle for example 910 to obtain a 900 angle. The outside of the bending leg can then be carefully heated, one leg raised and the seam bonded together.

## DRAPE FORMING

Where a specific thickness of Foamalux is to be curved to a smaller diameter than is possible by cold bending, or it is required to form a simple curved skin, it is possible to do this by softening a panel to an elastic state, draping over an appropriately shaped pattern and retaining it until cooled and rigid.




## THERMOFORMING

Components which are relatively simple and shallow in form are thermoformable from Foamalux when it is heated to an elastic state. Air-pressure forming is possible in the thermo-elastic range at about 130°C and pressures of about 2 bars and vacuum forming at about 170°C.
Thermoforming Foamalux sheets at temperatures higher than 180°C, will overheat and discolour and eventuallydestruct the sheet.

The temperature of the sheets is far more important than the temperature set on the machine.

It is key to heat the sheets uniformly. Machines that have individual adjustable upper and lower heater banks or plug-assisted devices make it easier to control the temperature of the sheet. As Foamalux foam PVC has a relatively low density, heating and cooling cycles are faster than with solid thermoplastics due to the narrower processing window than solid sheets.

Higher temperatures enhance definition but at the expense of surface finish. Most industrial press and vacuum formers for thermoplastics are suitable. Temperature controlled moulds will result in significantly better, sharper shapes, with best outcome achievable from machines which controllably heat both sides of the sheet.

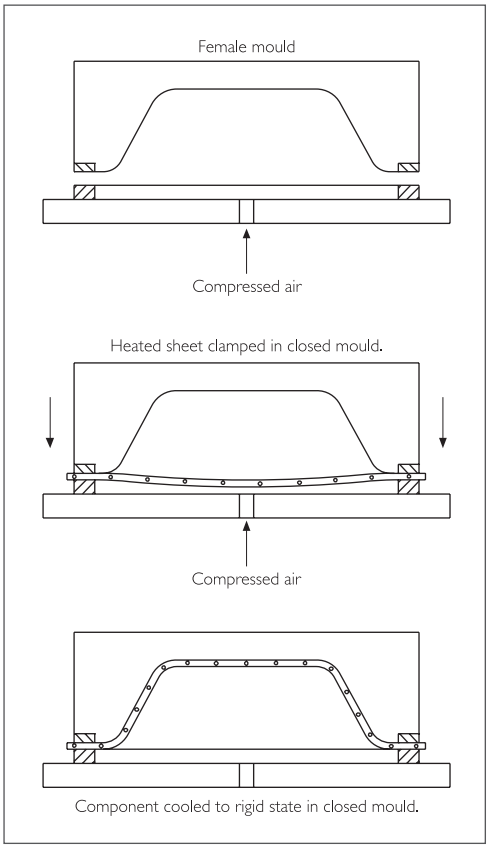
Large area panels and thick panels need some air pressure support during heating to avoid sag. Prior conditioning, by suspending in an air circulating oven at about 130°C, removes inherent stresses. Local overstretching of the material (thin projections, narrow recesses, etc) and premature mould contact should be avoided.

Male moulds are suitable for vacuum forming, female moulds for both vacuum and pressure forming. Secure clamping of the sheet during forming is essential to avoid shrinking; mold shrinkage (0.5 – 0.8%) and anisotropy of material should be taken into account during forming. Components must be completely rigid before removing from the mould. To minimize the risk of deformation always trim immediately after the formed part is removed from the mould and never place on a cold surface.

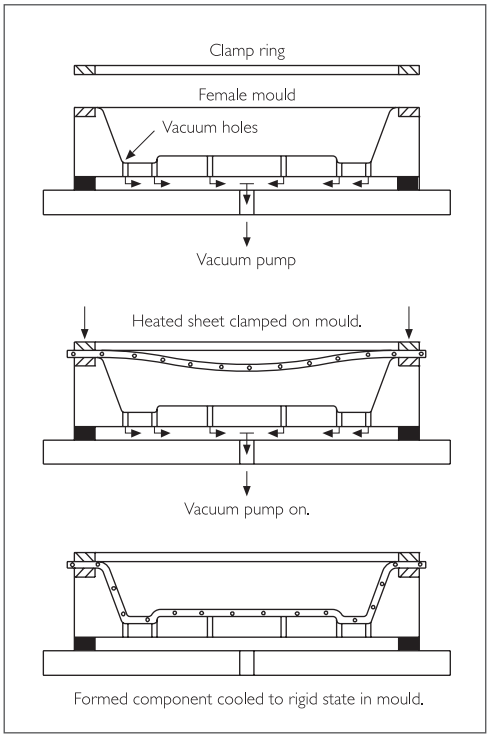
Realigning the sheet, adjustment in mound design and varying forming speeds can prevent wrinkling, webbing and bridging of the sheet.

When an item involves screen printing and thermoforming for its production, the thermoforming processes should always precede the printing. Foamalux sheets do not need to be pre-dried prior to forming.

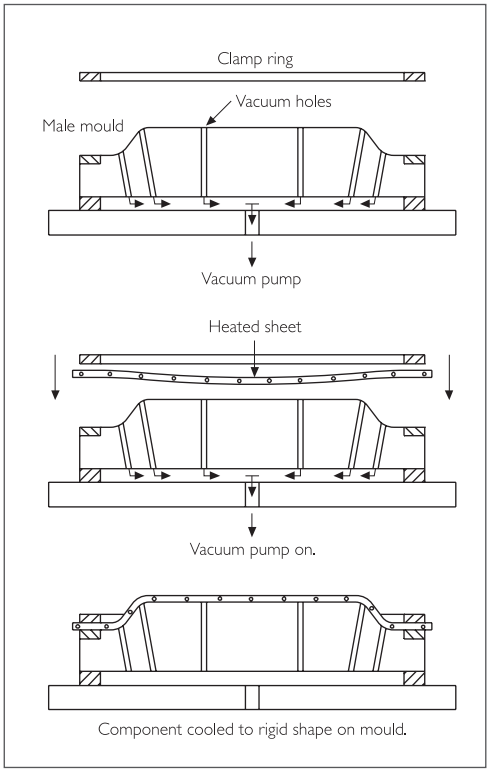
## PRESSURE FORMING IN A FEMALE TOOL




## VACUUM FORMING IN A FEMALE TOOL




## VACUUM FORMING IN A MALE TOOL



# Section 7
## Welding


| Welding | Page |
| --- | --- |
| Hot plate and hot air welding | 25 |

foamalux
FOAM PVC SHEET

# Welding

When fabricating Foamalux sheets the same welding methods and PVC filler rods used for solid PVC welding can be used, achieving a bond strength ratio of 50-90%.

As with all welding methods the sheet surface must be clean and the final bond strength depends on weld type, geometry, heating temperature and time, distribution of heat and skill level.

## HOT PLATE AND HOT AIR WELDING

Hot air welding and butt welding are most commonly used in fabrication.

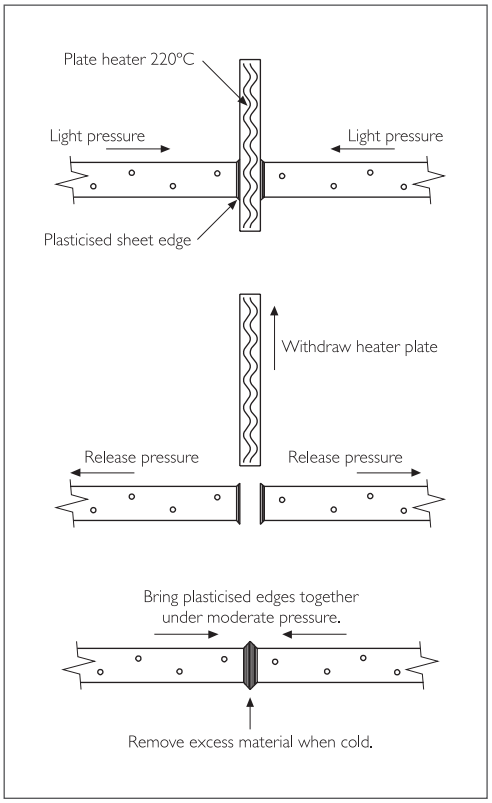
Butt welding of edges of sheets thicker than 3mm is possible using hot plate welding techniques. Sheet edges are plasticised through contact, under slight pressure, 0.05 - 0.07N/mm2, with a flat plate heater at a temperature of about 220°C. This is done to plasticise the sheet sufficiently for effective bonding and to induce material diffusion between the two substrates,

A welded joint is formed by withdrawing the tool, pressing the plasticised edges together under controlled pressure, 0.2- 0.27N/mm2, and cooling.

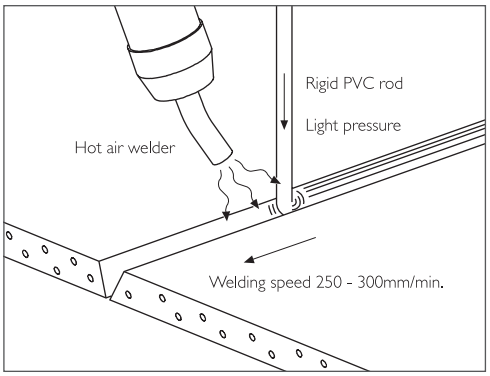
When welding using hot air, air temperatures should be about 250°C to plasticice the sheet and welding rod sufficiently for effective bonding. Speeds of 250-300mm/minute should avoid excessive heating which will damage the cell structure. Greater speed can be achieved with high speed welding nozzles. Where multiple welds of a joint are necessary, cooling between stages in fabrication is essential to avoid distortion when the component is moved.

Typical joints and the necessary panel preparations are illustrated in the diagrams.

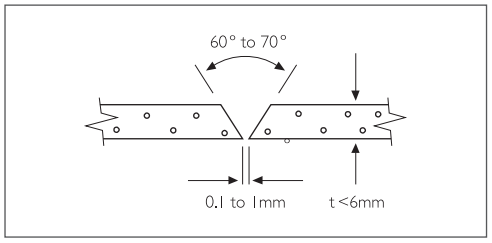
### HOT PLATE WELDING



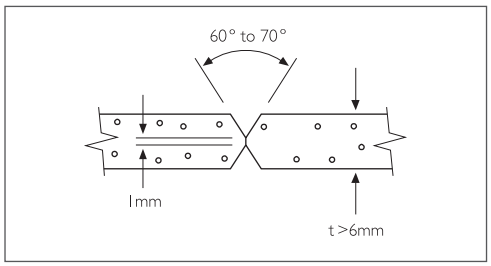

### WELDING TECHNIQUE



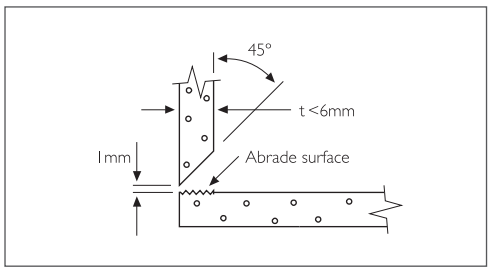

### SINGLE V BUTT WELD



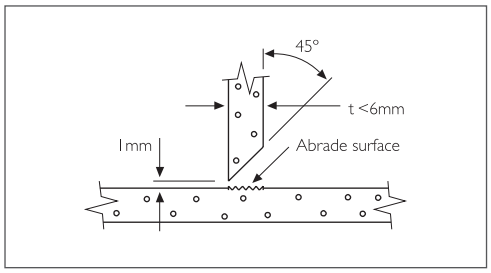
DOUBLE V BUTT WELD



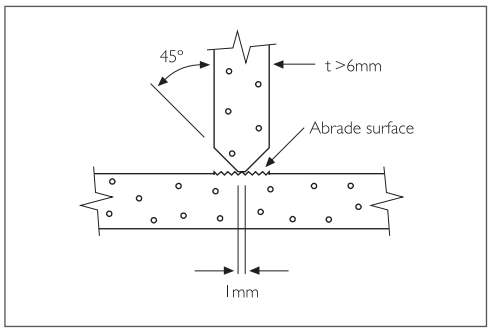

SINGLE BEVEL CORNER WELD




SINGLE BEVEL BUTT WELD




DOUBLE BEVEL BUTT WELD



foamalux
FOAM PVC SHEET

# Section 8
# Mechanical Fixing/Bonding


| Mechanical Fixing/Bonding | Page |
|---|---|
| Structures and frames | 28 |
| Panel orientation | 28 |
| Mechanical fastening | 29 |
| Screw joints | 29 |
| Nail/rivet joint | 30 |
| Bolt fixing | 30 |
| Hole, slot and washer size | 31 |

# Mechanical Fixing/Bonding

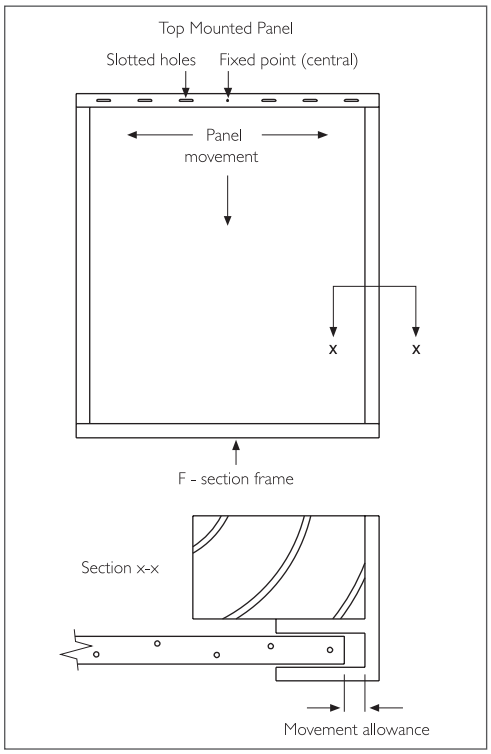
## STRUCTURES & FRAMES

In practice Foamalux is fixed to structures and frames made from many materials, most commonly wood and metals. In the design of these, the differences in thermal expansions must be accommodated, for example, when calculating sizes for fixing holes Adequate allowance for unrestricted movement is essential particularly when using Foamalux for cladding applications.

An illustration of a typical calculation is given in appendix I.

Fixings should be placed at centers not exceeding those recommended on page 29 and 30.

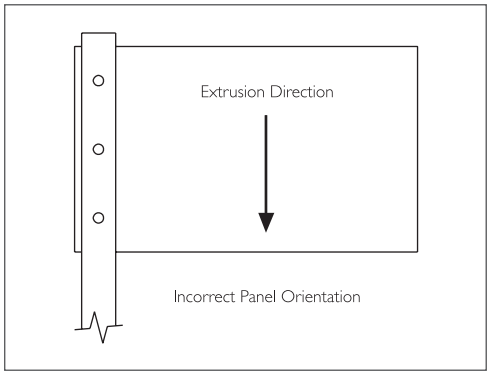
Where large and relatively heavy panels are being fixed, the panels should be suspended from a row of fixings located near the panel top, allowing it to expand down and to each side with temperature change. A large and relatively heavy panel mounted with most of its weight bearing on fixings near the bottom edge could distort at elevated temperatures. Large panels mounted on external walls should be spaced from the wall surface using battens to maintain a ventilating air gap of about 20mm behind the panel. Direct mounting of the panels to the walls could result in distortion due to heat build up.

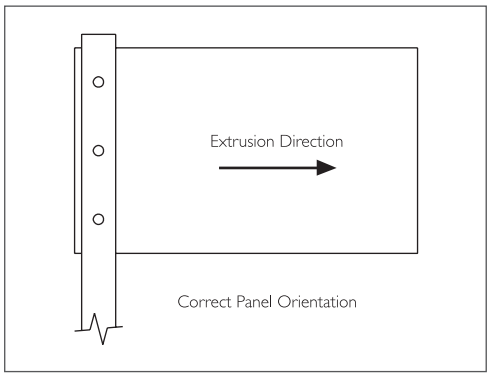



## PANEL ORIENTATION

Panel orientation should be considered when mounting, rectangular panels should be butted with matching edge length, for example, width – width or length – length in external applications, always support in the direction of extrusion.

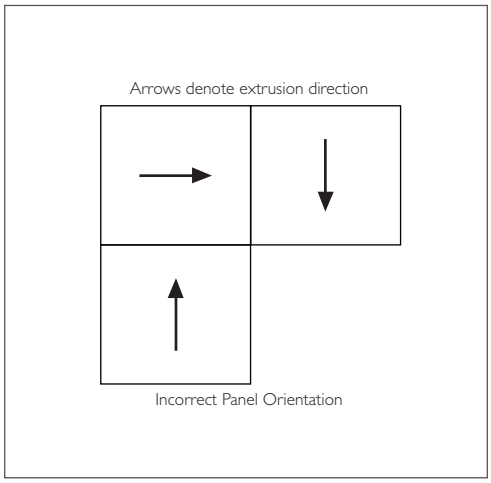
Extruded materials generally have fractionally greater flexural strength, and therefore resistance to bending, in the direction of extrusion. The protective film has the Foamalux brand running across the direction of extrusion, providing ease of identification for correct cutting of panels for such applications.

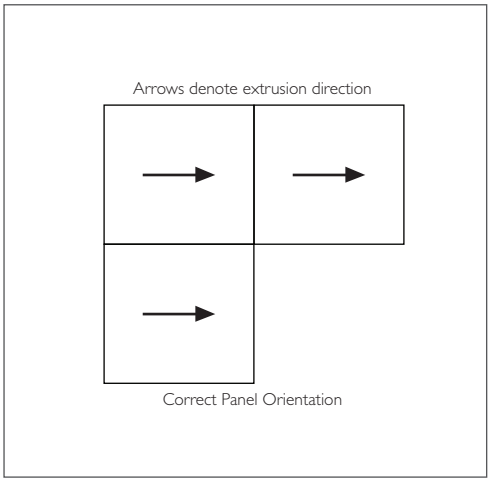



## Colour Panel Orientation

The refractive index of a panel viewed in the extrusion direction may vary to that viewed across the extrusion direction, which could result in a slight colour difference when the panels are placed close to each other. This will be more visible in darker coloured sheet. To avoid any optical colour variations when using multiple panels, it's important to always use them in the same orientation.




## MECHANICAL FASTENING

Panels can be fixed to supporting structures using screws, rivets or nails. Screws are most suitable as they are most controllable: tightening a screw and then backing it off slightly allows the panel to move with temperature changes without deformation. Always ensure adequate allowance for thermal expansion.

## SCREW JOINTS

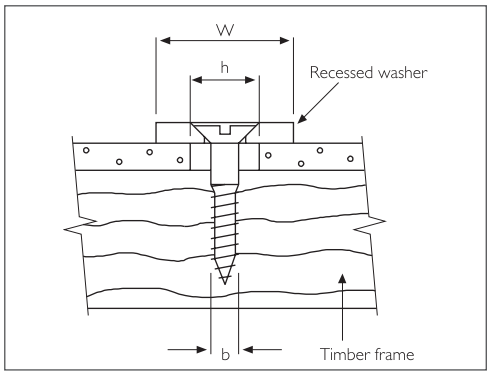
Holes or slots in a panel to accommodate fasteners should always be at least 25mm from the panel edge.

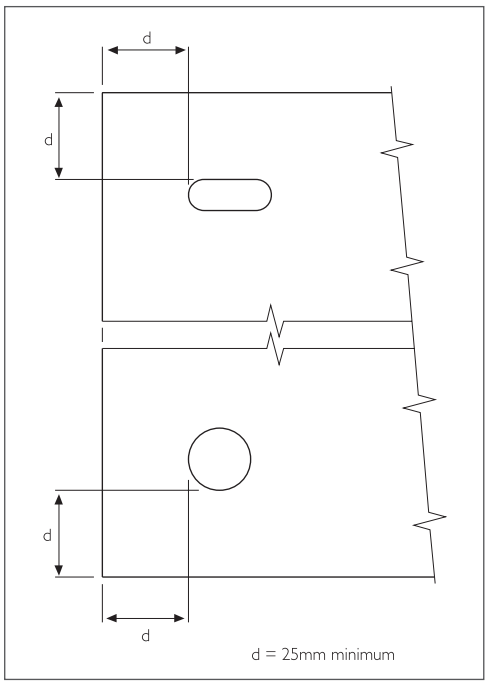
To fix components onto the surface of Foamalux, screws used for chipboard with a diameter of 3-4mm are best suited.

To fix external signage onto wooden or metal structures, it's recommended to use stainless steel façade screws with pre-fitted washers and rubber seals.

Always drill the hole approximately 5-6mm larger than the diameter of the screw shank. Avoid tightening the screws too much, but make sure the rubber washers seal the hole and fit smoothly onto the sheet, without applying too much pressure onto the sheet.

WOOD SCREW FIXING




Fasteners should be spaced at the separations given for each thickness of panel.

| Thickness | Fastener Spacing (mm) |
|---|---|
| 1mm | 100 - 150 |
| 2mm | 150 - 250 |
| 3mm | 250 - 350 |
| 4mm | 350 - 500 |
| 5-19mm | 500 |

## NAIL/RIVET JOINTS

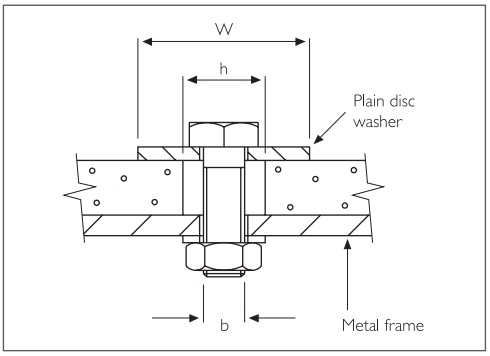
Nails and rivets can be used with small panels or in internal applications where there is little thermal movement since temperature differentials are small.

In all cases holes must be predrilled oversize through the panel to accommodate thermal movement. This in turn necessitates the use of an oversize washer on the fastener to provide adequate retention of the sheet and spread the load. Best suited are aluminum blind or pop rivets that have a stainless steel mandrela. Make sure to always position the closing head on the support structure or metal side and make the clearance holes in the sheet at least 2mm larger than the shank diameter of the rivet.

In order to avoid tension and material creeping use only pan head rivets with large heads or washers. Never use countersunk screws.

Appendix 1 gives details of appropriate hole, or slot and washer size for given sheet dimensions and fixing shank diameters. Self tapping screws can be used to mount lightweight items to panels thicker than 6mm.

BOLT FIXING

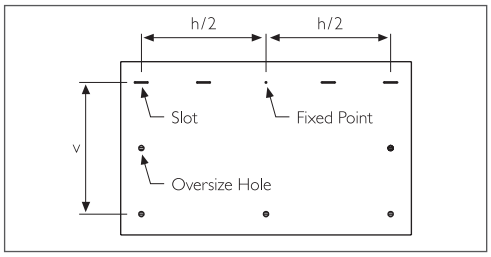


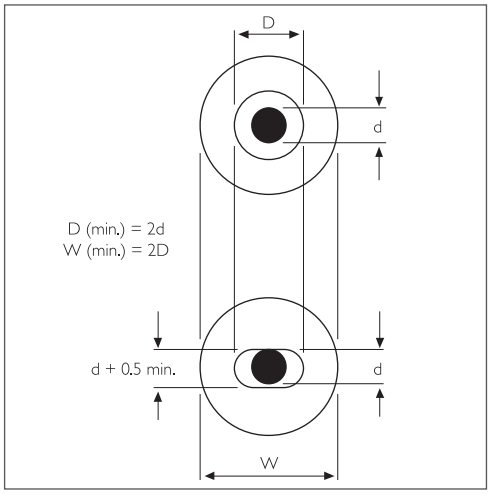

W = Washer Diameter
h = Hole Diameter
b = Fixing Shank Diameter

foamalux
FOAM PVC SHEET

## HOLE, SLOT AND WASHER SIZES

As Foamalux sheet can be subject to thermal expansion and contraction in all directions, it's essential to drill circular locating holes in the center of the edges and oblong holes to the left and right of the center. Always leave a space of about 25mm between the holes and the edge of the sheet.




| v,h | d = 4 D | W | d = 5 D | W | d = 6 D | W | d = 8 D | W | d = 10 D | W |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 5 | 10 | 6 | 12 | 7 | 14 | 9 | 18 | 11 | 22 |
| 400 | 6 | 12 | 7 | 14 | 8 | 16 | 10 | 20 | 12 | 24 |
| 600 | 7 | 14 | 8 | 16 | 9 | 18 | 11 | 22 | 13 | 26 |
| 800 | 8 | 16 | 9 | 18 | 10 | 20 | 12 | 24 | 14 | 28 |
| 1000 | 9 | 18 | 10 | 20 | 11 | 22 | 13 | 26 | 15 | 30 |
| 1200 | 10 | 20 | 11 | 22 | 12 | 24 | 14 | 28 | 16 | 32 |
| 1400 | 11 | 22 | 12 | 24 | 13 | 26 | 15 | 30 | 17 | 34 |
| 1600 | 12 | 24 | 13 | 26 | 14 | 28 | 16 | 32 | 18 | 36 |
| 1800 | 12 | 24 | 13 | 26 | 14 | 28 | 16 | 32 | 18 | 36 |
| 2000 | 13 | 26 | 14 | 28 | 15 | 30 | 17 | 34 | 19 | 38 |
| 2200 | 14 | 28 | 15 | 30 | 16 | 32 | 18 | 36 | 20 | 40 |
| 2400 | 15 | 30 | 16 | 32 | 17 | 34 | 19 | 38 | 21 | 42 |
| 2600 | 16 | 32 | 17 | 34 | 18 | 36 | 20 | 40 | 22 | 44 |
| 2800 | 17 | 34 | 18 | 36 | 19 | 38 | 21 | 42 | 23 | 46 |
| 3000 | 18 | 36 | 19 | 38 | 20 | 40 | 22 | 44 | 24 | 48 |

d = fixing shank diameter
D = minimum hole diameter or slot width
W = minimum washer diameter
v = vertical panel dimension
h = horizontal panel dimension

# Section 9
## Bonding/Lamination


| Bonding/lamination | Page |
|---|---|
| Adhesive bonding | 33 |
| Adhesive films/vinyls | 34 |
| Vinyl graphics | 34 |
| Lamination | 34 |
| Mounting photographs/prints | 34 |

# Bonding/Lamination

Prior to processing, e.g. adhesive bonding or printing, the user must satisfy himself by trial that the qualities of Foamalux are appropriate for the intended use. To ensure that the finish is to the required quality level the user must suitably prepare the sheet.

## ADHESIVE BONDING

Foamalux can be bonded to itself and a variety of materials such as ABS, GRP, Polycarbonate, uPVC and various woods and metals.

Recommendations on adhesives used for bonding are made on the basis of tests, following each manufacturer's recommendations on surface preparation, bonding conditions, application of primers and adhesives.

The user should also satisfy himself, preferably by testing, that any adhesive or bonding material will be suitable for his specific application. The user should at all times follow the adhesive manufacturer's recommendations as to suitability, surface preparation, use of primers, application methods, curing times and conditions to be satisfied for effective bonding. Manufacturers' health and safety precautions should also be observed.

It's essential to use the appropriate adhesive. Never use standard PVC adhesives as they are not transparent or UV-stabilised, so joints will remain visible and may discolour when used in outdoor applications.

### Bonding Foamalux to Foamalux

Solvent Adhesives - Based on methyl ethyl ketone (MEK), tetrahydrofuran (THF) and cyclohexanone. Adhesives set as solvents evaporate; successful bonding requires application of pressure and components fitted together accurately as solvent based adhesives will not fill gaps.

### Bonding Foamalux to Other Materials

1. Reaction Adhesives - There are two basic types: 1-part adhesives set by reacting with moisture; 2-part adhesives set by the reaction between a chemical base and a catalyst.

- 1-part adhesives - polyurethane or cyanoacrylate based - set very quickly and are ideal when small components.

- 2-part adhesives - polyester, polyurethane, polymethacrylate or epoxy based - are slower to cure, but ideal for bonding Foamalux to metals, wood and masonry.

2. Contact Adhesives - These are used when bonding sheets of Foamalux to flat surfaces and are based on solvent solutions of synthetic rubbers - e.g. polychlorophene or nitrile rubber. Both surfaces to be joined should have adhesive applied: after solvent evaporation bring the two surfaces together under pressure.

Double sided pressure sensitive adhesive tapes are a very efficient and effective means of attaching flat panels to each other and to support structures and of attaching other flat materials to Foamalux.

The table overleaf shows an overview of suitable adhesives per material.

| Characteristic | Contact Adhesive | 2-Part PU | Silicon Modifier Polymer | Elastic 2-part Acrylate | Adhesive Tape |
|---|---|---|---|---|---|
| Wood | ✔ | ✔ | | | |
| Chipboard | ✔ | ✔ | | | |
| Aluminum | | | ✔ | ✔ | |
| Galvanized Steel | | | ✔ | ✔ | |
| Brickwork | | ✔ | ✔ | | |
| Concrete | | ✔ | ✔ | | |
| Glass | | ✔ | ✔ | | |
| Thermoplastics | | ✔ | | | ✔ |
| Expanded Polystyrene | | ✔ | ✔ | | |
| Rubber | ✔ | | | | |
| Elastomers | ✔ | | | | |
| PVC foam | ✔ | | | | |
| Paper | ✔ | | | | |
| Cardboard | ✔ | | | | |
| Textiles | ✔ | | | | |
| Leather | ✔ | | | | |

Ensure adequate allowance for thermal expansion relative to ambient temperature are calculated prior to fixing. (see Appendix 1)

## ADHESIVE FILMS/VINYLS

The smooth, even surface of Foamalux foam PVC makes it the ideal substrate for lettering films and vinyl graphics. The following points need to be considered when determining film type;

- Location (indoor/outdoor)
- Durability (period of use)
- Type of bond (permanent/removable)
- Processability (printing/welding)

## VINYL GRAPHICS

Decorative and lettering / script graphics can be applied to Foamalux as the material forms a very rigid and stable substrate. The surface quality ensures excellent results free from visual distortion. All materials used in the application process must be dust and moisture free to avoid surface bumps and blisters. Application pressure must be even and strong enough to expel air from the vinyl but excessive pressure can lead to distortion of the graphic and may cause wrinkles.

## LAMINATION

All material used in the laminating process must be dust and moisture free while pressure must be even and strong enough to expel air across the sheet width. Roller laminating machines are essential for larger sizes and volumes of panels as ideal roll temperatures, pressures and laminating speed can be determined and accurately controlled to suit the sheet thickness and the material being applied. Wrinkles /Bubbles in the film are often caused by poorly aligned rollers or excessive roller pressure.

## MOUNTING PHOTOGRAPHS/PRINTS

Photomounting to Foamalux gives very high quality results due to the excellent surface finish and stability of the material.

Hand laminating is suitable only for small sizes and runs of panels. Laminating on a clear film protects the print or graphic surface while matt finishes can reduce glare.

Application of films which require high temperatures should be avoided as this could lead to buckling of the sheet. Once mounted leave photographs/prints to rest on a flat, even surface for a minimum of 3hrs and avoid flexing for 24hrs.

foamalux
FOAM PVC SHEET

# Section 10
## Printing & Painting


| Printing & Painting | Page |
|---|---|
| Surface preparation | 36 |
| Screen printing | 36 |
| Digital printing | 36 |
| Static | 37 |
| Reducing static electricity | 37 |
| Painting/varnishing | 38 |

# Printing & Painting

## SURFACE PREPARATION

A perfectly clean surface is an essential prerequisite to any substrate use; it must be free of dust, grease and fingerprints. Film protection at point of manufacturing maintains surface cleanliness and should be retained until the latest possible stage in processing.

Foamalux can be cleaned by wiping with a soapy water solution to remove any dust or dirt from prolonged storage. Residual soapy film may affect keying of inks and vinyls and should be removed using a lint free wipe moistened with aliphatic solvent – heptane or octane. These solvents will remove greasy deposits and dust or dirt adhering to the surface, as will methyl alcohol or methylated spirits. Always check the cleaner before use as they can dull the surface or embrittle the material. Cleaners must not contain silicone compounds, as residues of these prevent vinyl inks adhering. Wipe in one direction only; wiping with a circular motion can create additional static charge.

To remove any paint or other substances, isopropyl alcohol can be used carefully, though the sheet will need to be cleaned, rinsed with water and dried with a soft cloth afterwards. Never use brushes, squeegees or other sharp materials as they will damage the sheet surface.

Abrasive and alkaline cleaners will harm the surface finish and must be avoided. Please refer to Appendix II Chemical Resistance.

## PRINTING

The preparation required will be determined very much by the printer's experience of the foam sheet types and the printing equipment, inks and processing conditions which are used to give best results. Preparation may involve applying an anti-static or cleaning agent such as isopropyl alcohol or a suitable detergent.

1mm sheet has less flexural strength than thicker sheets and may not be suitable for all applications especially those in suspended applications. The end-user should satisfy themselves that the product is suitable for the proposed application.

## SCREEN PRINTING

UV curable, solvent based and vinyl inks formulated for rigid PVC adhere well to the surface of Foamalux Foam PVC. Use of unsuitable inks, i.e. with a high solvent content, is advised against as these may cause damage to the substrate and result in poor printing results. Tixotrope varieties are preferential over liquid based inks, whereas epoxy and enamel paints are unsuitable as they can cause substrate brittleness and even breakage on impact.

New or unfamiliar combinations of inks should be trialed prior to printing, the combination of ink and substrate should be matched with the envisaged printing process before launching a series production. Conditions of use (e.g outdoor signage), high traffic areas or additional processing of the printed substrates should also be considered when choosing ink type. Care should be taken during the drying process as the intense UV & IR energy may cause warping or discolouration of the sheet if over-exposed. The temperature must not exceed 50°C. Good quality results have been achieved using a 150-31 mesh with dot size resolution of 23.

## DIGITAL PRINTING

Foamalux Bright White has been engineered specifically for use with the new breed of high definition wide format digital printers and is increasingly chosen as the substrate for direct digital printing. Developed in consultation with digital equipment manufacturers and ink producers it meets the specific demands which this new technology has brought in terms of product performance and quality.

Print on the filmed side of the sheet, film should be removed slowly, in one direction to avoid additional static charge build up, for optimum print results clean using Ionized Air or Anti-Static Brush.

Ionized Air Bar/Gun The curtains or nozzles should be placed carefully at the sheet sides or above the surface of the sheet to maintain a constant stream of ionised air across the substrate.

Anti-Static Brush It is recommended to use an Anti-Static Brush with a range of surface resistivity

between 1012 to 1016 Ohms for insulative materials such as Foam PVC.

There is an array of environmental factors which are crucial for producing a quality print:

UV Lamp & Bulb Settings - Too low UV setting can result in inadequate ink adhesion due to insufficient cross-linking between the ink and substrate. Too high a setting may cause the substrate to discolour. The IR energy discharged by the bulbs may lead to overheating and possibly cause warping of the substrate.

Humidity - Excess ambient humidity increases static levels, which can lead to inadequate ink adhesion. Ink adhesion should be assessed 24 – 48 hours post print.

Colour/Image - Bright and transparent shades adhere better to the substrate than dark and opaque shades. Large blocks of singular colours are more likely to show static related printing anomalies in comparison to other images.

To achieve the best print image, it is recommended to run a trial print to ensure the optimum print settings are obtained.

## STATIC

Static Electricity is a natural environmental phenomenon that can produce unacceptable results in digital printing applications. In the case of PVC sheets, static can be generated from various sources, for example, when the protective film is removed, friction from transport, pressure of stacked sheets etc. The ultra-fine inkjet nozzles in modern printing equipment fire miniscule droplets of ink onto the surface of the print media and the presence of static electricity can cause these droplets to deflect from their intended path, resulting in variable ink coverage across the media causing overspray, shading and banding issues.

Static charge attracts dust prior to or during the printing process, causing poor quality prints and white-spotting. Ink can wick from the ink head onto the substrate if dust is transferred onto it.

Many of the substrates used within the Digital Print industry can be sensitive to static and it is vital that all precautions are taken when preparing these materials before printing. Listed below are a series of recommendations relating to the preparation of Foam PVC Sheets prior to processing through a digital print machine.

### Material Handling & Storage

- Always use lint free gloves when handling sheets and ensure that the surface to be printed is not touched by uncovered hands, as this can leave a greasy residue on the sheet.
- Avoid dragging sheets across each other, as this can impart additional and unwanted static into the material.
- Allow newly delivered material time to settle before printing, as movement during transportation can cause an increase in static.

### Humidity & Temperature

Humidity & temperature can have a direct influence on the static levels within all materials:

- Try to maintain the relative humidity at 50% or more within the area of the printing machine. This can be controlled with the use of a Hygrometer.
- Avoid fluctuations in temperature around the machine by keeping doors and windows closed and minimising drafts and areas of rapidly moving air.

### REDUCING STATIC ELECTRICITY

The use of professional ionizing equipment is the most effective way of discharging static electricity and it is recommended that ionization should take place immediately prior to printing.

- Anti-static Bars are now standard on many machines and in most cases these can also be retro-fitted to printers that do not already have one installed.
- Ionizing Air Pistols are also highly effective. They replace the need to wipe the sheet with an anti-static brush or cloth whilst also ionizing the surface at the same time.
- Anti-static brushes are less effective than a bar or a pistol but can be used in the absence of the other two options.

It is advisable to always wear protective gloves and keep sheets covered when not in use. It is in the interest of the printer to ensure that all static is discharged from substrates prior to digitally printing them.

## PAINTING/VARNISHING

Foamalux applications which require precisely matched colours can be achieved via film lamination or painting. Sheet surfaces are excellent for painting and varnishing. Surface preparations should again be followed.

All application techniques - brush, roller, and spray can be used. Water-dilutable component paint systems are suitable for indoor use. Vinyl and two part polyurethane based paints are ideal for outdoor use, painting the surface will also enhance outdoor durability.

As with inks, hard or solvent based paints such as Acrylate, Acrylic and Acrylate base paints may cause embrittlement, consult paint manufacturer guidelines to ensure suitability for use with Foam PVC. Drying temperature >50°C are not recommended.

Outdoor applications benefit from the light stabilizing effect of topcoats which will delay UV damage and discoloration, a primer coat is also recommended for such applications. Lighter coloured sheets are preferential as darker colours are more heat absorbent and as a result may discolour or suffer localized buckling.

# Section 11
## Finishing


| Finishing | Page |
|---|---|
| Decorative finishes | 40 |
| Edge finishing | 40 |

# Finishing

## DECORATIVE FINISHES

Foamalux is an excellent substrate, suitable for a varied range of decorative finishing techniques. Decorative composites suitable for furniture or interior works can be created by sanding the surface of Foamalux to create a roughened surface. Using a 2 part PU adhesive this can be bonded to sheet metal or synthetic resin similarly roughened.

## EDGE FINISHING

Creating a seamless edge which covers the visible cell structure on cut edges of Foamalux can be achieved via the following methods:

- 1mm strips of Foamalux can be bonded to the edges with a Tetrahydeofuran (THF) based adhesive, excess material can be trimmed using a sharp cutting tool.

- Cells can be filled with putty suitable for use with PVC, once dry this can be sanded to give a smooth finish.

- Melamine heat activated edge banding can be applied along the edges with an industrial iron. However overheating >60° is to be avoided as this can lead to localized buckling of the sheet. Always follow the manufacturer's guidelines regarding application.

foamalux
FOAM PVC SHEET

# Section 12
# Design Factors


| Design Factors | Page |
|---|---|
| Thermal expansion | 42 |
| Thermal insulation | 42 |

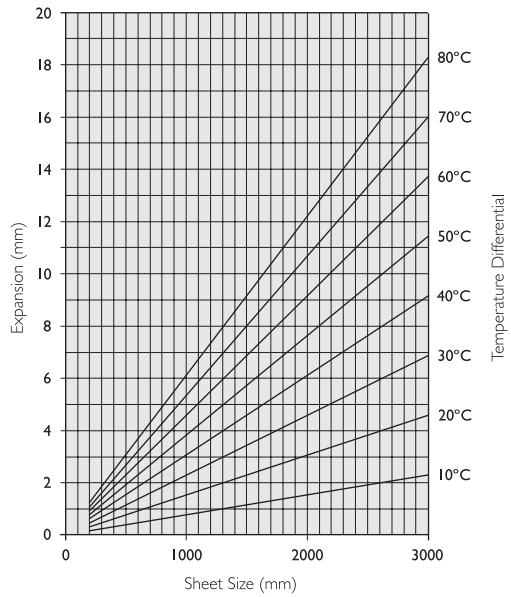
# Design Factors

## THERMAL EXPANSION

Dimensional change can occur both in sheet length and width due to changes in temperature; this is known as thermal expansion. The coefficient of linear expansion specifies by how much a sheet of 1 meter in length expands if the temperature increases by 1 Kelvin. Foamalux sheets have a linear expansion coefficient of 0.068mm/mK.

It is essential to consider the variations caused by Thermal Expansion when installing Foamalux sheets both in indoor and short term outdoor applications. This movement must not be inhibited otherwise distortion, warping or localized buckling will occur, bearing in mind that expansion affects both the length and width of the sheet.

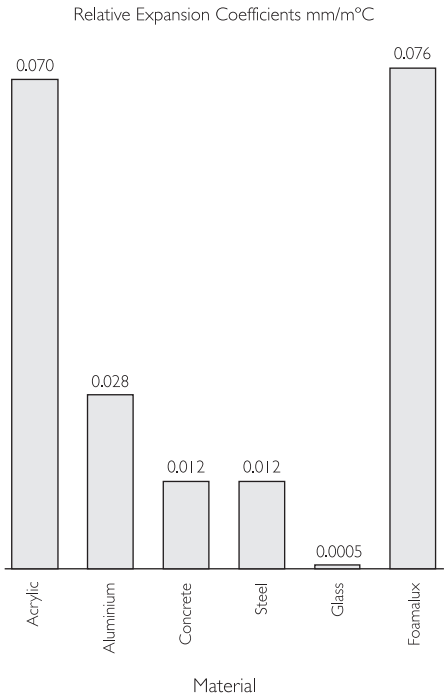
The service temperature range limits of Foamalux are -20°C to +60°C, the overall temperature differential range of eighty degrees.




Foamalux can be used in conjunction with many common building and accessory materials; the thermal expansion properties of which must also be taken into consideration. The graph on the right illustrates the relative coefficients for various materials. Foamalux clearly expands much more than timber, concrete, brickwork and metals when their temperature is changed by the same amount.

## THERMAL INSULATION

Thermoplastic materials have a lower thermal conductivity (k) than that of typical construction materials, giving Foamalux products a higher insulation value.




The heat transfer coefficient is dependent upon thickness, thermal conductivity and exposure of the material. The overall heat transfer coefficient for Foamalux when used in cladding, insulation of ceilings and external walls or other applications in which one surface is exposed externally are:

| Thickness | Heat Transfer Coefficient K-Value |
|---|---|
| 10mm | 3.13W/m²K |
| 19mm | 2.19W/m²K |

* Note K-Values vary depending on heat flow, size of panel, distance between sheets and number of sheets. Where "K" Kelvin is a unit measurement for temperature.

## Low Temperatures

It should be noted that at lower temperatures, freezing point and below all foam PVC sheet materials become less pliable and more brittle, therefore more susceptible to damages through rough handling and impact.

Foamalux should be handled with care in cold weather; all knocks and excessive twisting and bending should be avoided. When cutting, drilling or performing any other operations, care must be taken in colder conditions.

foamalux
FOAM PVC SHEET

# Section 13
## Application Factors


| Application Factors | Page |
|---|---|
| UV stability | 45 |
| Exterior signage | 45 |
| Wind loading | 45 |
| Precipitation | 45 |
| Sound insulation | 45 |

# Application Factors

## UV STABILITY/EXTERIOR SIGNAGE

Outdoor applications expose the sheets to sunlight; this influences the sheet in three ways; changing the temperature, creating thermal movement; degradation of the surface.

Surface degradation, indicated by colour change or “yellowing”, is slightly influenced by heat; however UV radiation from sunlight can have a much greater effect. It is not recommended to install PVC sheets in South-facing applications; this is subject to maximum direct UV radiation. The exposed white or coloured sheet surface could discolour in a few weeks or months depending on the season. In North-facing, or permanently shaded situations where there is no exposure to direct sunshine colour change could be gradual over a period of years.

Covering the surface with a UV opaque ink or laminate will reduce the effect of UV in relation to surface degradation. There is virtually no degradation in internal applications, except those close to heat source applications or applications fitted close behind glass subject to sunlight, where excessive temperatures can be reached.

The above apply to Foamalux Colour, Foamalux White, Foamalux Ultra and Foamalux Xtra as this family of products have several similar material and surface characteristics. When the black recycled core of Foamalux Xtra is exposed to UV radiation it can fade to grey depending on exposure conditions.

## WIND LOADING

Any panel mounted outside a building will be subject to wind loading. Panels mounted on walls will not be critically affected by positive wind pressures which force the sheet against the wall; however, negative or suction pressures will tend to pull the sheet away from the wall.

In many external applications where panels are edge mounted in frames, they will be subject to wind pressures from both sides.

When designing an external application, wind loads should be estimated and provision made from secure means of fixing, for example, the fixing spacing should be as recommended in the Mechanical Fastening Section (Section 8, page29).

Wind loads can be calculated using BS CP3:Chapter V: Part 2

## PRECIPITATION

All panels in external situations will be subject to precipitation in the form of rain, sleet, snow and hail. Foamalux foam PVC does not absorb moisture from precipitation; therefore will not degrade or deteriorate in the presence of moisture.

Hail storms may cause damage through impact of large hail stones on cold panels.

## SOUND INSULATION

Foamalux Foam PVC has good acoustic characteristics and provides sufficient sound insulation for a lightweight material, when used in the construction of exhibition stands, wall cladding and interior partitions.  Airborne noise transmission reduction provided by a single leaf partition is dependent on the mass of the material it is the end users responsibility to ensure that material is appropriate for use.

RATED SOUND REDUCTION INDEX RW

| Thickness | Airborne Sound Reduction Index Rw |
|---|---|
| 10mm | 28dB |
| 19mm | 32dB |

foamalux
FOAM PVC SHEET

# Section 14
## Cleaning & Maintenance


| Cleaning & Maintenance | Page |
|---|---|
| Safety | 47 |
| Cleaning | 47 |
| Chemical resistance | 47 |

## SAFETY

The majority of substances used for cleaning aren't that harmless. Skin and eye contact as well as accidental consumption can cause medical problems. Moreover, many cleaning agents are also inflammable and must only be used in well-ventilated areas far from ignition sources or heat.

## CLEANING

In principle, the surfaces of Foamalux sheets are ready for use. However, in order to ensure prime conditions for the adhesion of paints, bonding agents and adhesive films, the surfaces must be free of dust, grease, fingerprints and such before carrying out any decorative work, printing, lamination etc.

Isopropyl alcohol to clean the surface of the sheet of stubborn dirt, luke warm water or a solution of cleaner and luke warm water can also be used. Note: Allow adequate time for evaporation as streaks can form unless completely dry.

Use non-fluffy, lint free towels to wipe clean. Wipe in one direction only. Stubborn marks can be removed with a fibrous cleaning pad, accepting a slight dulling of the surface.

Liquid cleaners must be checked for suitability before use. They frequently leave residues, dull the surfaces (especially acetone) or embrittle the material, as many solvents contain a high level of aromatic components.

Sanding and grinding cause irreversible changes of the surfaces.

## CHEMICAL RESISTANACE

The base material for Foamalux foam PVC is highly resistant to attack from chemicals and from pollutants in the atmosphere. Contact with solvents and wet wood preservatives must be avoided. In general, the chemical resistance depends on reaction time, temperature of application, pressure, purity and concentration of the reagents as well as mechanical stress and other influences.

In short Foamalux resists aqueous acids, alkalis and saline solutions as well as oils and apiphatic compounds. Sheets will swell or dissolve in aromatic compounds, chlorinated hydrocarbons, ether, esters and ketones. Please see Appendix 2 for reference data.

Foamalux fulfils the requirements of both the RoHS and WEEE directives of the European Union on the restriction of certain hazardous substances.

Foamalux sheets do not contain

- Lead
- Mercury
- Cadmium
- Hexavalent chromium
- Polybrominated biphenyls (PBB)
- Polybrominated diphenyl ethers (PBDE)
- Formaldehyde
- Any CFC's
- Asbestos
- Any plasticisers
- Silicon

foamalux
FOAM PVC SHEET

# Section 15
## Important Notes


| Important Notes | Page |
|---|---|
| Environmental policy | 49 |
| Responsibility of end user | 49 |

# Important Notes

## ENVIRONMENTAL POLICY

Brett Martin Limited is committed to ensuring that high standards of environmental performance are maintained at all the Company's sites. The Company will continue to operate in such a way as to reduce any adverse effects on the environment arising from our activities, to a minimum and to consider the environment and the well being of future generations in all Company policy decisions.

The Company will develop and implement activities which make efficient use of energy and raw materials and reduce emissions to earth air and water, wherever practicable.

The Company will design our products to meet society's standards for the protection of health and the natural environment and, to this end, it is the policy of the Company continually to develop and refine systems of planning, organization and control and to continue to strive for improvements in plant and technology.

The Company will promote the correct use of our products to minimise pollution and operate a policy where re-use and recycling is of any waste material, both in-plant and by external users, is encouraged and implemented as far is possible.

Furthermore the Company accepts that all employees have a responsibility for minimising harm to the environment and will continue a process of continuous learning and development, allied to systematic training and information, to improve employee awareness of environmental principles.

## RESPONSIBILITY OF END USER

The information contained in this publication is based on current knowledge and is in our opinion reliable. However the correctness of this information cannot be guaranteed for every application and for the results arising from their use.

The user/processor is always responsible for ensuring that the materials and processes are appropriate, cost effective and suitable for the intended purpose and location and they comply with laws and regulations.

Technical knowledge and skills as customary in trade and industry, a normally developed capacity to make judgements as well as knowledge and observance of the applicable regulations appertaining to work, safety and hygiene are assumed.

# Appendices


| Appendices | | Page |
|---|---|---|
| Appendix 1 | Thermal expansion calculation | 51 |
| Appendix 2 | Chemical resistance | 53 |
| Appendix 3 | Adhesives manufacturers | 57 |

# Appendix 1

## THERMAL EXPANSION CALCULATION

**Example 1**

A Foamalux sheet is to be used to form a sign panel on the outside of a building. It is expected that the panel temperature will be as low as -12°C in winter and as high as 31°C in summer. The panel measures 1.2m wide and 1.5m high in a workshop at a temperature of 18°C. The panel is to be hung from its top edge with a fixed point at the centre, so that thermal movement takes place from the top down and from the centre horizontally to each side. Estimate the clearance required in retaining channels which will frame the bottom and sides of the sheet.

1. Width

Dimension change in cooling from 18°C to -12°C
Temperature change = 30°C
Initial width = 1.2m
Expansion coefficient = 0.068mm/m°C
Reduction in width = 1.2 x 30 x 0.068 = 2.45mm

Dimension change in heating from 18°C to 31°C
Temperature change = 13°C
Initial width = 1.2m
Expansion coefficient = 0.068mm/m°C
Increase in width = 1.2 x 13 x 0.068 = 1.06mm

Total width change = w = 2.45 + 1.06 = 3.51mm, 4mm when rounded up to the nearest mm.

As the sheet is fixed at its centre it will move half of this distance each side of the fixed point, i.e. 2mm clearance is required in each side channel.

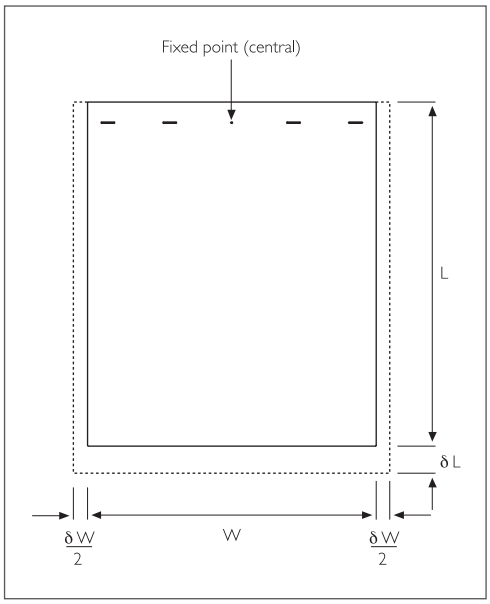
2. Length

Dimension change in cooling from 18°C to -12°C
Temperature change = 30°C
Initial length = 1.5m
Expansion coefficient = 0.068mm/m°C
Reduction in length = 1.5 x 30 x 0.068 = 3.06mm

Dimension change in heating from 18°C to 31°C
Temperature change = 13°C
Initial length = 1.5m
Expansion coefficient = 0.068mm/m°C
Increase in length = 1.5 x 13 x 0.068 = 1.33mm

Total length change = L = 3.06 + 1.33 = 4.39mm, 5mm when rounded up to the nearest mm.

As the sheet is fixed at the top it will move vertically 5mm, i.e. 5mm clearance is required in bottom channel.



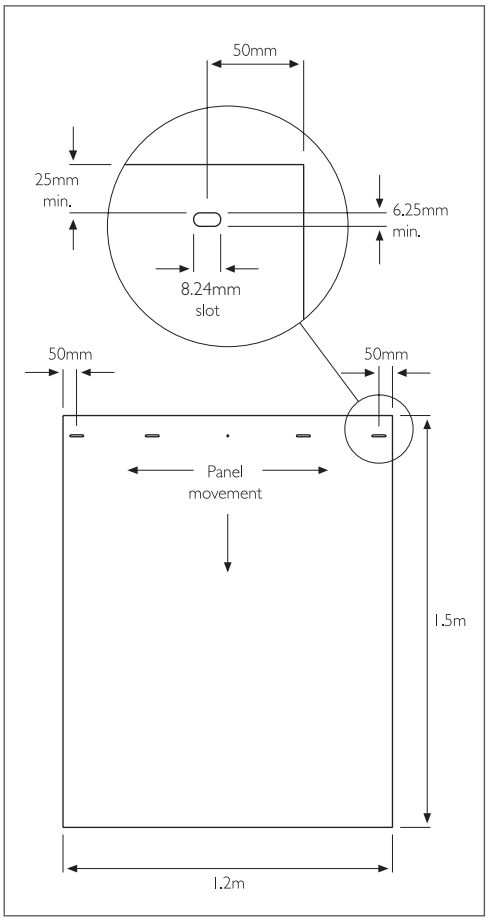

**Example 2**

The Foamalux sheet in the previous example is to be fixed with a row of screws along its top edge, with outer screws 50mm in from sheet sides. Estimate the size of slot required to accommodate thermal movement. Using screws that have a shank diameter of 6mm, the example below demonstrates how to calculate the required slot size to accommodate thermal movement.

Sheet width 1.2m
Outer slot separation =1.2 - (2 x 0.05) = 1.1m
Distance from fixed point to slot centre = 0.55m
This distance contracts as sheet cools from 18°C to -12°C by an amount 0.55 x 30 x 0.068 = 1.12mm
This distance expands as sheet heats up from 18°C to 31°C by an amount 0.55 x 13 x 0.068 = 0.49mm

The fixing must be centered in a slot with a length which can accommodate, at least, the greater amount of thermal movement. In this case, the greater movement is 1.12mm from cooling.

Minimum slot length = fixing shank diameter + (2 x greater thermal movement)
= 6 + (2 x 1.12) = 8.24mm



foamalux
FOAM PVC SHEET

# Appendix 2

## CHEMICAL RESISTANCE OF FOAMALUX

KEY:
+ good resistance
- poor resistance

| Chemical name | Resistance at 23°C |
|---|---|
| Acetaldehyde 40% | + |
| Acetaldehyde 100 % | - |
| Acetic acid 10% | + |
| Acetic acid 20% | + |
| Acetic acid 80% | + |
| Acetic acid, glacial | + |
| Acetic anhydride | - |
| Acetone | - |
| Adipic acid | + |
| Allyl alcohol 96% | + |
| Allyl chloride | - |
| Alum | + |
| Aluminium alum | + |
| Aluminium chloride | + |
| Aluminium fluoride | + |
| Aluminium hydroxide | + |
| Aluminium oxychloride | + |
| Aluminium nitrate | + |
| Aluminium sulphate | + |
| Ammonia gas (dry) | + |
| Ammonia, liquid | - |
| Ammonium acetate | + |
| Ammonium alum | + |
| Ammonium bifluoride | + |
| Ammonium carbonate | + |
| Ammonium chloride | + |
| Ammonium fluoride 25% | + |
| Ammonium hydroxide | + |
| Ammonium metaphosphate | + |
| Ammonium nitrate | + |
| Ammonium persulphate | + |
| Ammonium phosphate | + |
| Ammonium sulphate | + |
| Ammonium sulphide | + |
| Ammonium thiocyanate | + |
| Amyl acetate | - |
| Amyl alcohol | + |
| Amyl chloride | - |
| Aniline | - |
| Aniline chlorohydrate | - |
| Aniline hydrochloride | - |
| Anthraquinone sulphonic acid | + |
| Antimony trichloride | + |
| Aqua regia | + |
| Aromatic hydrocarbons | - |
| Arsenic acid 80% | + |
| Arylsulphonic acid | + |
| Barium carbonate | + |
| Barium chloride | + |
| Barium hydroxide | + |
| Barium sulphate | + |
| Barium sulphide | + |
| Beer | + |
| Beer sugar liquors | + |
| Benzaldehyde 10% | + |
| Benzaldehyde, above 10% | - |
| Benzene | - |
| Benzine | + |
| Benzoic acid | + |
| Bismuth carbonate | + |
| Bleach 12% Cl | + |
| Borax | + |
| Boric acid | + |
| Bromic acid | + |
| Bromine liquid | - |
| Bromine water | + |
| Butadiene | + |
| Butane | + |
| Butanol normal | + |
| Butanol iso | + |
| Butyl acetate | - |
| Butyl phenol | + |
| Butyric acid | + |
| Cadmium cyanide | + |
| Calcium bisulphite | + |
| Calcium carbonate | + |
| Calcium chlorate | + |
| Calcium chloride | + |
| Calcium hydroxide | + |
| Calcium hypochlorite | + |
| Calcium nitrate | + |
| Calcium oxide | + |
| Calcium sulphate | + |
| Carbon disulphide | - |

foamalux
FOAM PVC SHEET

| | | | |
|---|---|---|---|
| Carbon dioxide | + | Ethyl acetate | - |
| Carbon monoxide | + | Ethyl acrylate | - |
| Carbon tetrachloride | + | Ethyl alcohol | + |
| Carbonic acid | + | Ethyl chloride | - |
| Castor oil | + | Ethyl ether | - |
| Caustic potash | + | Ethylene bromide | - |
| Caustic soda | + | Ethylene chlorohydrin | - |
| Chloroacetic acid | + | Ethylene dichloride | - |
| Chloral hydrate | + | Ethylene glycol | + |
| Choric acid 20% | + | Ethylene oxide | - |
| Chlorine (dry) | - | Fatty acids | + |
| Chlorine (wet) | - | Ferric chloride | + |
| Chlorine water | + | Ferric hydroxide | + |
| Chlorobenzene | - | Ferric nitrate | + |
| Chloroform | - | Ferric sulphate | + |
| Chlorosulphonic acid | + | Ferrous chloride | + |
| Chrome alum | + | Fluoboric acid | + |
| Chromic acid 10% | + | Fluorine gas (wet) | + |
| Chromic acid 50% | - | Fluorine gas (dry) | + |
| Citric acid | + | Fluorosillicic acid 25% | + |
| Copper carbonate | + | Formaldehyde | + |
| Copper chloride | + | Formic acid | + |
| Copper cyanide | + | Fructose | + |
| Copper fluoride | + | Fruit juices and pulp | + |
| Copper nitrate | + | Furfural | - |
| Copper sulphate | + | Gallic acid | + |
| Cottonseed oil | + | Glucose | + |
| Cresol | + | Glycerine | + |
| Cresylic acid | - | Glycol | + |
| Crotonaldehyde | - | Glycolic acid | + |
| Crude oil | + | Heptane | + |
| Cupric fluoride | + | Hexane | + |
| Cupric sulphate | + | Hexanol, tertiary | + |
| Cuprous chloride | + | Hydrobromic acid 20% | + |
| Cyclohexanol | - | Hydrochloric acid 10% | + |
| Cyclohexanone | - | Hydrochloric acid 35% | + |
| Detergents | + | Hydrocyanide acid | + |
| Dextrin | + | Hydrofluoric acid 50% | + |
| Dextrose | + | Hydrogen | + |
| Diazo salts | + | Hydrogen peroxide 30% | + |
| Diglycolic acid | + | Hydrogen peroxide 90% | + |
| Dimethylamine | + | Hydrogen phosphide | + |
| Dioctyl phthalate | - | Hydrogen sulphide | + |
| Disodium phosphate | + | Hydroquinone | + |
| Distilled water | + | Hydroxylamine sulphate | + |
| Esters | - | Hypochlorous acid | + |
| Ethers | - | Iodine | - |

foamalux
FOAM PVC SHEET

| | | | |
|---|---|---|---|
| Kerosene | + | Nicotine acid | + |
| Ketones | - | Nitric acid, anhydrous | - |
| Lactic acid 25% | + | Nitric acid 10% | + |
| Lauric acid | + | Nitric acid 60% | + |
| Lauryl chloride | + | Nitric acid 68% | + |
| Lead acetate | + | Nitrobenzene | - |
| Lead chloride | + | Nitrous oxide | + |
| Lead sulphate | + | Oils and fats, vegetable | + |
| Lead tetraethyl | + | Oleic acid | + |
| Linoleic acid | + | Oleum | - |
| Linseed oil | + | Oxalic acid | + |
| Lithium bromide | + | Oxygen | + |
| Lubricating oil | + | Ozone | + |
| Machine oil | + | Palmitic acid | + |
| Magnesium carbonate | + | Paraffin | + |
| Magnesium chloride | + | Perchloric acid 10% | + |
| Magnesium citrate | + | Perchloric acid 15% | + |
| Magnesium hydroxide | + | Perchloric acid 70% | + |
| Magnesium nitrate | + | Petrol | + |
| Magnesium sulphate | + | Petrol high octane | + |
| Maleic acid | + | Phenol | + |
| Malic acid | + | Phenylhydrazine | - |
| Mercuric chloride | + | Phenylhydrazine hydrochloride | + |
| Mercuric cyanide | + | Phosgene gas | + |
| Mercurous nitrate | + | Phosgene liquid | - |
| Mercury | + | Phosphoric acid 10% | + |
| Methyl alcohol | + | Phosphoric acid 85% | + |
| Methyl bromide | - | Phosphoric acid (yellow) | + |
| Methyl chloride | - | Phosphorus pentachloride | + |
| Methyl methacrylate | - | Phosphorus trichloride | - |
| Methylene chloride | - | Photographic solutions | + |
| Methyl ethyl ketone | - | Pictic acid | - |
| Methyl iso butyl ketone | - | Potassium alum | + |
| Methyl sulphate | + | Potassium bicarbonate | + |
| Methyl sulphuric acid | + | Potassium bichromate | + |
| Milk | + | Potassium borate | + |
| Mineral oils | + | Potassium bromate | + |
| Molasses | + | Potassium bromide | + |
| Monochloracetic acid | + | Potassium carbonate | + |
| Muriatic acid | + | Potassium chromate | + |
| Naphtha | + | Potassium chlorate | + |
| Napthalene | - | Potassium chloride | + |
| Natural gas | + | Potassium cyanide | + |
| Nickel chloride | + | Potassium dichromate | + |
| Nickel nitrate | + | Potassium ferricyanide | + |
| Nickel sulphate | + | Potassium ferrocyanide | + |
| Nicotine | + | Potassium fluoride | + |

foamalux
FOAM PVC SHEET

| | |
|---|---|
| Potassium hydroxide | + |
| Potassium nitrate | + |
| Potassium perborate | + |
| Potassium perchlorate | + |
| Potassium permanganate 10% | + |
| Potassium permanganate 25% | + |
| Potassium sulphate | + |
| Propane liquid | + |
| Propane gas | + |
| Propargyl alcohol | + |
| Propyl alcohol | + |
| Propylene dichloride | - |
| Plating solutions | + |
| Rochelle salts | + |
| Sea water | + |
| Selenic acid | + |
| Sewage | + |
| Sillicic acid | + |
| Silver cyanide | + |
| Silver nitrate | + |
| Silver plating solution | + |
| Silver sulphate | + |
| Soaps | + |
| Sodium acetate | + |
| Sodium alum | + |
| Sodium benzoate | + |
| Sodium bicarbonate | + |
| Sodium bisulphate | + |
| Sodium bisulphite | + |
| Sodium bromide | + |
| Sodium carbonate | + |
| Sodium chlorate | + |
| Sodium chloride | + |
| Sodium cyanide | + |
| Sodium dichromate | + |
| Sodium ferricyanide | + |
| Sodium ferrocyanide | + |
| Sodium fluoride | + |
| Sodium hydroxide 10% | + |
| Sodium hydroxide 50% | + |
| Sodium hypochlorite | + |
| Sodium nitrate | + |
| Sodium peroxide | + |
| Sodium sulphate | + |
| Sodium sulphide | + |
| Sodium sulphite | + |
| Stannic chloride | + |
| Stannous chloride | + |
| Starch | + |
| Stearic acid | + |
| Sulphur | + |
| Sulphur dioxide (dry) | + |
| Sulphur dioxide (wet) | + |
| Sulphur trioxide | + |
| Sulphuric acid 3% | + |
| Sulphuric acid 70% | + |
| Sulphuric acid 80% | + |
| Sulphuric acid 85% | - |
| Sulphurous acid | + |
| Tallow | + |
| Tall oil | + |
| Tannic acid | + |
| Tartaric acid | + |
| Tetraethyl lead | + |
| Tetrahydrofurane | - |
| Thionyl chloride | - |
| Terpineol | + |
| Titanium tetrachloride | - |
| Tanning liquors | + |
| Toluene | - |
| Transformer oil | + |
| Tributyl phosphate | - |
| Trichlorethylene | - |
| Triethanolamine | + |
| Trimethyl propane | + |
| Trisodium phosphate | + |
| Turpentine | + |
| Urea | + |
| Urine | + |
| Water - deionized | + |
| Water - distilled | + |
| Water - demineralized | + |
| Water - salt | + |
| Whiskey | + |
| Wines | + |
| Xylene | - |
| Yeast | + |
| Zinc chloride | + |
| Zinc nitrate | + |
| Zinc sulphate | + |

# Appendix 3

## ADHESIVES MANUFACTURERS

**Henkel Ltd.**
Wood Lane End
Hemel Hempstead
Hertfordshire
HP2 4RQ
Tel: 01442 278 000
Fax: 01442 278 293
Email: technicalservice.loctite@uk.henkel.com
Web: www.loctite.co.uk

**3M United Kingdom plc**
3M Centre
Cain Road
Bracknell
Berkshire
RG12 8HT
England
Tel: 01344 858000
Fax: 01344 858278
Email: innovation.uk@mmm.com
Website: www.3M.co.uk

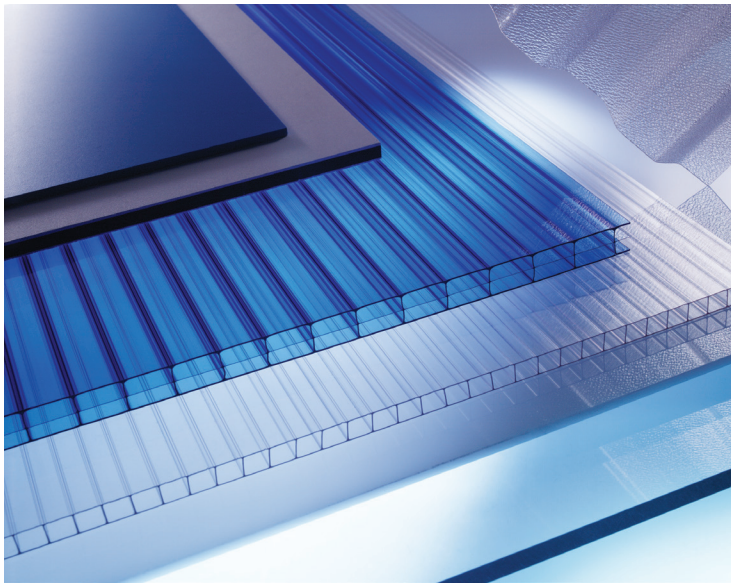
**Stelmax Ltd**
Unit 21-23 Gloster Road
Martlesham Heath Industrial Estate
Ipswich
Suffolk
IP5 3RD
England
Tel: +44 (0) 1473 622265
Fax: +44 (0) 1473 610651
Email: sales@stelmax.co.uk
Web: www.stelmax.co.uk

**Dunlop Adhesives Ltd**
Building Adhesives Limited
Longton Road
Trentham
Stoke-on-Trent
ST4 8JB
England
Tel: +44 (0) 1782 591100
Fax: +44 (0) 1782 591101
Email: info@building-adhesives.com
Web: www.dunlop-adhesives.com

**Bostik Ltd**
Ulverscroft Road
Leicester
LE4 6BW
England
Tel: 01785 272727
Fax: 0116 268 9211
Email: technical.service@bostik.com
Website: www.bostik.co.uk

**Dow Corning Europe SA**
Parc Industriel – Zone C
Rue Jules Bordet
7180 Seneffe
Belgium
Tel: +32 64 888 000
Fax: +32 64 888 401
Web: www.dowcorning.com

DOWNLOAD
OUR FREE APP



Brett Martin's plastic sheets product range includes extensive options in foam PVC, polycarbonate, PVC, acrylic, aPET, PETg, SAN and styrene.

BRETT MARTIN

Plastic Sheets

Head Office and Global Sales
Brett Martin Plastic Sheets
24 Roughfort Road,
Mallusk, Co. Antrim
Northern Ireland
BT36 4RB

Tel: +44 (0) 28 9084 9999
Fax: +44 (0) 28 9083 6666
Email: mail@brettmartin.com

For the latest information visit the company's web site:
**www.brettmartin.com**

BSI
Certificate No. Q09125
BS EN ISO 9001 : 2008



0714/4488