VACUUM BONDING OF SAFETY AND ARCHITECTURAL GLASS LAMINATES
Cytec specializes in the manufacture and distribution of vacuum bagging materials used in the vacuum bonding process of safety and architectural glass laminates. We also design and manufacture a wide range of re-usable vacuum bagging systems suitable for use in the glass laminating industry.

From our facilities in the UK, France, Italy and the USA, we convert and distribute a complete range of materials and hardware required for the bonding process.

Vacuum Bagging Film

Nylon has traditionally been the choice of film used as the vacuum bag. This is due to its excellent heat resistance and very high strength, coupled with good elongation properties. Both sheeted and tubular films are used, typically in thicknesses of 50 or 75 µm. In some cases, if the laminate is very large and heavy, highly puncture resistant 100 or 125 µm film may be used.

Tubular film is often used to ‘envelope bag’ the laminate. The laminate is placed inside an open ended length of tubular film, thus requiring the sealing of just the two ends rather than all around the periphery of the laminate. This method is particularly suited to bonding of lightweight laminates which are easy to manipulate.

Sheet film is widely used in the industry. In this case the glass laminate is placed on top of a length of the film which is subsequently folded over the top of the laminate and sealed all around the periphery.

### Product Selector Guide: Vacuum Bagging Film

<table>
<thead>
<tr>
<th>Product reference</th>
<th>Color</th>
<th>Thickness</th>
<th>Widths</th>
<th>Max use temp</th>
<th>Cure method</th>
</tr>
</thead>
<tbody>
<tr>
<td>VACFILM 450V</td>
<td>Violet</td>
<td>50 µm and 75 µm (100 µm and 125 µm available to special order)</td>
<td>600mm (24 in), 900mm (36 in), 1200mm (48 in), 1500mm (60 in), 2000mm (80 in)</td>
<td>170°C (338°F)</td>
<td>Oven or autoclave</td>
</tr>
<tr>
<td>VACFILM 800G</td>
<td>Green</td>
<td>50 µm and 75 µm (100 µm and 125 µm available to special order)</td>
<td>600mm (24 in), 900mm (36 in), 1200mm (48 in), 1500mm (60 in), 2000mm (80 in)</td>
<td>200°C (392°F)</td>
<td>Oven or autoclave</td>
</tr>
</tbody>
</table>

**Flashtape**

High temperature resistant tape used to secure the peel ply and breather fabric around the edge of the glass laminate.

### Product Selector Guide: Flashtape

<table>
<thead>
<tr>
<th>Product reference</th>
<th>Color</th>
<th>Thickness</th>
<th>Width</th>
<th>Length</th>
<th>Max use temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLASHTAPE 1</td>
<td>Blue</td>
<td>62 (µm)</td>
<td>25mm (1 in) and 50mm (2 in)</td>
<td>66m (217 ft) rolls</td>
<td>205°C (401°F)</td>
</tr>
</tbody>
</table>

FLASHTAPE 1 is a polyester tape with a high temperature silicone adhesive which strips cleanly from the glass following bonding.
Peel Ply Fabric

Peel ply is a woven nylon heat cleaned fabric which is positioned around the periphery of the laminate in direct contact with the PVB or EVA adhesive interlayer. This material is used as a barrier and effectively prevents the vacuum bag and breather fabric polluting the adhesive layer. The fabric is hot knife slit to avoid loose fibers contaminating the cured adhesive and is easily stripped away from the laminate at the end of the cure cycle (Fig 1).

Product Selector Guide: Peel Ply Fabric

<table>
<thead>
<tr>
<th>Product reference</th>
<th>Width</th>
<th>Length</th>
<th>Weight</th>
<th>Max use temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>A100PS</td>
<td>50mm (2 in), 75mm (3 in), and 100mm (4 in)</td>
<td>100m (328 ft) rolls</td>
<td>80gsm</td>
<td>204 °C (400°F)</td>
</tr>
<tr>
<td>B100 fine weave</td>
<td>50mm (2 in), 75mm (3 in), and 100mm (4 in)</td>
<td>100m (328 ft) rolls</td>
<td>60gsm</td>
<td>204 °C (400°F)</td>
</tr>
</tbody>
</table>

If an alternative to textured peel ply finish is required, Cytec offers release films which are designed to leave a smooth finish

<table>
<thead>
<tr>
<th>Product reference</th>
<th>Width</th>
<th>Length</th>
<th>Weight</th>
<th>Max use temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>A6000</td>
<td>1.2m (4 ft) and 1.5m (5 ft)</td>
<td>150m rolls (492 ft)</td>
<td>80gsm</td>
<td>232 °C (450°F)</td>
</tr>
</tbody>
</table>

Breather Fabric

Breather fabric is made from high temperature polyester fiber. Its function is to ensure vacuum is evenly distributed and enable air to be removed from the laminate. It is wrapped around the laminate on top of the peel ply and strips are also positioned on the upper and lower surface of the glass, linked to the vacuum port. Strips of breather fabric can also be positioned on the upper and lower surface of the glass to improve vacuum flow (Fig 2). For high pressure autoclave processing, we recommend a heavyweight coarse fiber material.

For oven processing under vacuum only, a lighter weight, more economical material can be used. A range of widths are available.

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Figure 1.
Positioning of A100PS peel ply held in place with Cytec blue FLASHTAPE 1, 25mm (1 in) wide.

Figure 2.
Breather fabric is attached to the glass and across the flat surfaces using Cytec blue FLASHTAPE 1, 25mm (1 in) wide. Note that the material must extend to the underside of the vacuum port.
Product Selector Guide: Breather Fabric

<table>
<thead>
<tr>
<th>Product reference</th>
<th>Width</th>
<th>Length</th>
<th>Weight</th>
<th>Max use temp</th>
<th>Cure method</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIRBLEED 100</td>
<td>75mm (3 in), 100mm (4 in) and 150mm (6 in)</td>
<td>100m (328 ft) rolls</td>
<td>150gsm</td>
<td>205°C (401°F)</td>
<td>Oven</td>
</tr>
<tr>
<td>AIRBLEED 10</td>
<td>75mm (3 in), 100mm (4 in) and 150mm (6 in)</td>
<td>50m (164 ft) rolls</td>
<td>330gsm</td>
<td>205°C (401°F)</td>
<td>Oven or autoclave</td>
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</tbody>
</table>

Vacuum Bag Sealant Tapes

This product is used to seal the nylon film vacuum bag to itself, forming a leak proof, and vacuum tight seal. It consists of high temperature extruded mastic (Fig 3). When vacuum bagging with sheet film, it is likely that there may be some excess film on the top surface once the bag has been folded over the glass. This requires the use of extra sealant tape, sealing the excess film on the top surface, thus creating a pleat. Sealed pleats can be seen in Fig 9-10. It is imperative that the sealant tape extends to the very top of the pleat.

![Image of vacuum bag sealant tape](image-url)

**Figure 3.** Sealant tape attached to the vacuum film. Release paper should be left in place until ready to complete the bagging process. Note that the lower part of the vacuum breach unit must be positioned prior to sealing the bag together.

Product Selector Guide: Vacuum Bag Sealant Tape

<table>
<thead>
<tr>
<th>Product reference</th>
<th>Color</th>
<th>Thickness</th>
<th>Width</th>
<th>Length and quantity</th>
<th>Max use temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTS90B</td>
<td>Black</td>
<td>3mm (0.1 in)</td>
<td>12mm (0.5 in)</td>
<td>15m (49 ft) rolls, 22 rolls per box</td>
<td>150°C (300°F)</td>
</tr>
<tr>
<td>SMS142</td>
<td>Yellow</td>
<td>3mm (0.1 in)</td>
<td>12mm (0.5 in)</td>
<td>9m (30 ft) rolls, 32 rolls per box</td>
<td>205°C (401°F)</td>
</tr>
<tr>
<td>UCS180</td>
<td>Cream</td>
<td>3mm (0.1 in)</td>
<td>13mm (0.51 in)</td>
<td>7.6m (25 ft) rolls, 40 rolls per box</td>
<td>180°C (350°F)</td>
</tr>
</tbody>
</table>

LTS90B is our lower temperature economical tape with high tack. SMS142 operates at higher temperatures and exhibits lower levels of tack. Both are designed for use in this application.

Vacuum Hardware

To apply vacuum to the bag, a range of vacuum connectors is required. This is a very simple range of products which offer excellent heat resistance, durability and vacuum integrity. Products available include:

- Vacuum breach unit 2 part
- Brass non return male plug
- Brass non return female socket
- Vacuum gauge fitted with non-return socket
- High temp silicone rubber hose
Vacuum Couplings

Our double shut off plug and socket units are fitted with high temperature Viton seals (Fig 7). Typically the male plug is bonded to the upper part of the vacuum breach unit (Fig 4). The female part is attached to the vacuum hose (Fig 5-6). Once connected, vacuum can be applied. The valves can be quickly and easily disconnected without loss of vacuum to allow the finished lay up to be moved to the oven or autoclave.

Figures 4-7.
Show two part vacuum breach unit (with 50mm (2 in) base plate), vacuum hose end and socket assembled, vacuum hose with threaded end only and finally brass plug and socket units.

Vacuum Breach Units

These two part metallic units are positioned in the vacuum bag and provide a pathway for air to be removed once the vacuum bag has been sealed. The male thread of the top part of the unit is designed to allow a clean hole to be cut in the vacuum bag. The top part is inserted into the hole in the base part of the unit and tightened. This automatically cuts a hole in the vacuum bag. The resulting disc of film can be removed by unscrewing the unit before re-positioning and tightening the two parts together again. A silicone washer ensures an air tight seal is achieved.

Figures 8-9.
Sealant tape attached to the vacuum film. Release paper should be left in place until ready to complete the bagging process. Note that the lower part of the vacuum breach unit must be positioned inside prior to sealing the bag.
Vacuum Hoses

Our high strength, high temperature silicone hoses are designed for both oven and autoclave applications. They are fitted with an internal reinforcing spring to prevent the hose collapsing at high autoclave pressures. An additional benefit with these hoses is that in the event of damage, they are quickly and easily repairable at the customers own premises.

Figure 10.
The vacuum hose and socket unit are attached to the vacuum breach unit, allowing air to be evacuated and vacuum applied. If the position of the bag needs adjusting (i.e. if bridged), the hose can be easily and quickly disconnected. To release vacuum depress the nipple of the non-return plug and manipulate the film as required.

Vacuum Gauge

It is imperative that once the vacuum has been applied and all the air is evacuated from the bag, the vacuum level is checked. This is achieved by using a vacuum gauge.

The hose and non-return socket are disconnected and replaced with the vacuum gauge, also fitted with a non-return socket (Fig 11). If the needle indicator on the gauge descends, there is a leak somewhere in the bag and this will require sealing.

Areas to check are the tightness of the fastening of the vacuum port or leak paths between the sealant tape and the vacuum bagging film. If leaks are not adequately dealt with, the quality of the finished product will be seriously compromised. An ultrasonic leak detector is available in our range to assist in locating leaks.

Figure 11.
Shows the vacuum gauge and socket assembly attached to the vacuum breach unit.
**Reusable Vacuum Bag (RVB)**

Multi-use reusable vacuum bag systems manufactured from high performance silicone rubber compound

**Benefits**

- Reusable system saves time compared to traditional consumable lay up
- Decreased material waste
- Reduced risk of operator error
- Cost effective versus traditional consumables over the life of the bag
- Bespoke bags manufactured to customer’s exact requirements
- Maintenance and repair service available

- Currently being successfully used at 15 bar autoclave pressure
- Supplied with 6mm (0.25 in) BSP vacuum fittings as standard (custom fittings also available)
- Designed for use with traditional breather fabric or PTFE mesh
- A range of compatible vacuum hoses and ancillaries available

<table>
<thead>
<tr>
<th>Physical Properties</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Maximum service temperature</td>
<td>230°C (440°F)</td>
</tr>
<tr>
<td>Color</td>
<td>Blue</td>
</tr>
<tr>
<td>Hardness</td>
<td>40 (Shore A)</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>1160 psi</td>
</tr>
<tr>
<td>Elongation at break</td>
<td>520%</td>
</tr>
</tbody>
</table>

*Other grades and colors of rubber available

*Figure 12. The LOCK SEAL interlocking silicone rubber seal is designed to locate and close with ease.*

**Silicone Vacuum Bagging Aid**

Cytec’s silicone rubber vacuum bag aid INTENSIFLEX is designed to reduce potential vacuum bag failures caused by sharp edges and open areas in the glass laminate. INTENSIFLEX is a 12mm (0.5 in) thick uncured silicone rubber sheet that easily molds to the geometry of the glass laminate features simplifying the vacuum bagging operation. INTENSIFLEX is cured at 90°C (194°F) and can be re-used several times making this unique product a cost effective solution for solving vacuum bag failures.
Complete Composites Portfolio

Suitable for low cost vacuum bag processing, excellent surface finish, ease of use with a broad processing window, good combination of mechanical performance, fatigue resistance and toughness, and supplied across a wide range of fabrics and fibers. Resin chemistries include epoxies, phenolics, vinyl esters, bismaleimides, thermoplastics, cyanate esters, HT polyimides, polyesters, ceramics.


Design: Supporting tool design optimization.
Tooling Materials: Tooling prepregs for outstanding surface finish and longevity.
Tool Manufacture: Complete manufacturing service.
Reusables: Soft tooling technology including reusable bags, heater blankets, intensifiers and caul sheets.

For increased part manufacturing productivity, quality, reliability and reduced waste. From simple shapes to complex kits of any/all of our products. From CAD to fully assembled vacuum bag kits.

Vacuum bagging films including film welding, perforating and processing, breather fabrics, peel plies, release films, flow media, release fabrics, sealants, reusable vacuum systems to suit specific tooling requirements, elastomeric tools, and design services.

Epoxies, phenolics, vinyl esters, cyanate esters, bismaleimides, HT polyimides, surfacing films, structural films, bond primers, lightning strike, silicone sealants, paste/potting/foams.

Ablatives, pre-forms, friction materials, cross-plied materials, high-drape formats, selective impregnation, core materials.

Material science, polymer chemistry, processing science, and technical service and application engineering, e.g. design assistance with resin infusion networks, design for manufacturing, crashworthiness and intrusion analysis.

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