PALL

Specialty Materials

Sealing Guide/FAQ's
Basic Filtration Concepts/
Chemical Compatibility

*Filtration. Separation. Solution.*SM

General Sealing Information

When sealing microporous membranes or media into a plastic part, there are a number of factors that should be taken into consideration. These include handling, environmental, and design factors, as well as, the integral properties of the media and other materials.

You also need to consider how the seal is made. Will the membrane be in contact with the plastic part or is it actually the membrane's support mesh? Are you sealing membrane to plastic or plastic to plastic? What are the thermoplastic qualities of the two materials? Are you sealing like or unlike materials?

The following is a list of tips that will help you when handling and sealing membranes.

Handling and Environmental Factors

- When handling membranes, individuals should wear gloves; oils on the hands can affect membrane properties adversely.
- Static eliminators are helpful for handling and placement of die cut membrane and processing of membrane ribbons, especially for high speed operations. The relative humidity in the membrane processing area can also be a factor.
- Tension control is important to ensure proper tracking of roll stock membrane and membrane ribbons.
- Parts and work surfaces must be clean and free of particulates.
- Molded parts must be free of silicone-based, mold release agents.

Design Factors

- The design of the seal area in a membrane device is a critical factor in the integrity of the finished seal. The seal is nearly always the weakest area in the device. It is desirable to radius all angles in contact with the membrane. It is also preferable to have the flow in the finished device go in the direction of the seal so that the membrane is supported in the device when filtration occurs; filtration in the direction away from the seal can cause stress on the seal.
- Minimize excess flash around the seal area.
- Parallelism and alignment of tooling to part and fixture is critical.
- Molded parts should be designed to eliminate or minimize stressed areas.

Material Properties

- Media are available on a variety of support materials. The support determines many of the sealing and handling characteristics.
- For some supported membranes and composite media, the seal will actually be made between the support or composite material and the plastic part, not the membrane. It is important to keep this in mind when determining melting temperatures, dwell time, etc.
- Use the appropriate resin for the desired process.
- Parameters for each of the sealing methods will vary depending on both the media properties and those of the plastic to which it is being sealed.

Sealing Methods

There are several possible sealing methods available to the designer of a plastic part or housing containing a membrane or other microporous media:

- Adhesive sealing
- Mechanical sealing
  - Insert molding
- Heat sealing
  - Ultrasonic welding
  - Heated dies
  - Radio frequency

This information is intended to serve only as a guide. Users should verify the conditions appropriate to their specific use. Information on our materials is also available on either our industrial web site at HYPERLINK http://www.pall.com/industrial or our healthcare web site at HYPERLINK http://www.pall.com/healthmedia.

For additional information on adhesive sealing and ultrasonic welding, please visit our supplier market on-line at HYPERLINK http://www.pall.com/materials. Here you will find various suppliers who may be able to assist you with your sealing needs. If you would like to speak to someone for additional information please call us at 1-800-362-6276.

Adhesive Sealing

A pressure-sensitive adhesive seal uses a thin layer of adhesive to seal the media to the housing. The adhesive can be applied in a peel-and-stick format. Check with a converting company for information on configurations of membranes, adhesives, support layers, and release liners. UV sets can also be used.

When evaluating an adhesive seal, compatibility of the adhesive with the housing, the membrane, and the intended application need to be considered. Compatibility of the adhesive with the membrane and housing polymers should be discussed with your adhesive supplier or media converter.

Industry standards for adhesives can be critical. Some industries have basic requirements for the adhesive used; specifically, the electronics and medical industries. Most adhesive manufacturers are aware of these requirements and have adhesives that comply with the appropriate standards or regulations. If not, check with an adhesive manufacturer that specializes in your industry.

- Polyurethanes, epoxies, or similar chemically compatible pure polymers work well as adhesives.
- Avoid using adhesives containing suspended solids; particulate–laden adhesives will not penetrate the pores, causing poor adhesion and probable by-pass of particulates into the downstream filtrate.
- Surface treatment, such as plasma or chemical treatment, may increase adhesive wettability.
- Unfilled polymers are preferable regardless of the method used for sealing because they will wet the surface of the membrane better than filled polymers, creating a stronger bond.
- Do not use cyanoacrylate when sealing Supor® membranes.

For More Information

Adhesive Sealing

Avery Dennison
Specialty Tape Division
Painesville, OH USA
440-358-2600
www.averydennison.com

Loctite
Rocky Hill, CT USA
860-571-5100
www.loctite.com

Heat Sealing

Heat sealing uses a variety of heat sources and pressure to melt the housing and membrane together. Heat seals are typically classified according to the heat source; among these are ultrasonic welding, heated dies, and radio frequency welding.

With heat seals it is possible to form two different types of bonds. If the membrane and housing materials have the proper thermal characteristics, the media and housing can be melted together to form a secure seal. Another type of bond occurs when the housing material melts at a lower temperature than the membrane.

The molten housing plastic penetrates into the structure of the medium, forming a seal. Many of Pall Corporation's materials form this type of seal, including Pallflex® composite media.

Ultrasonic Welding (UW)

Ultrasonic welding is based on heat, pressure and time. The heat is created by the use of high frequency mechanical motion (vibrations). The high frequency energy travels through the material and must be focused at the desired melt location. The greater the vibration the hotter the material becomes.

- A high frequency, low amplitude setting is preferred.
- For weld areas greater than 1.5" diameter, use 20 kHz; for smaller diameters, use 40 kHz.
- Seal to an energy director rather than a wide, flat surface.
- Avoid long duration weld times at high amplitudes.
- Some single, and most multiple, ultrasonic welds may cause damage to membranes.
- Avoid secondary ultrasonic weld cycles.
- Provide a smooth transition from the seal to the membrane.
- Cutting, placement and sealing of membrane can be accomplished at one time.
- Cushion parts to dampen vibrations throughout the entire part.
- Care must be taken to minimize excess ultrasonic vibrations to maintain pore integrity. Improper use of ultrasonics can lead to damage of the microporous membrane's pore structure.

For More Information

Ultrasonic Welding

Branson Ultrasonic Corporation
Danbury, CT USA
203-796-0334
www.branson-plasticsjoin.com

Dukane Corporation
St. Charles, IL USA
630-584-2300
www.dukane.com

Heated Dies

Heat is transferred through a die under pressure directly to the materials to be joined for the appropriate time necessary to form an integral seal. The heated die melts the housing or the media at the point of contact which, in combination with the applied pressure, bonds the housing and membrane together.

- The plastic to which the microporous membrane is being sealed should have a melting temperature similar to or lower than the membrane.
- Keep geometry of the membrane simple; round membrane coupons provide the best results.
- To minimize plastic buildup on tooling, use lower temperatures and higher pressures for longer times.
- A high-temperature, non-stick coating on the heat seal die is recommended.
- Adequate seal land width is important, 50-125 mils is recommended.
- Transparency in the seal area is usually indicative of a complete seal.
- Short seal times may result in the membrane and its backing pulling apart when the seal die is removed. This is known as delamination.
- In some cases, sealing and cutting may be accomplished in a single step. This depends on the membrane type and the shape of the part and must be determined during the design phase.
- Relationships between time, temperature, and pressure must be optimized through experimentation. Larger coupon sizes and seal land widths will require higher pressures.

For More Information

Heated Dies

Forward Technology Industries, Inc.
Minneapolis, MN USA
612-559-1785
www.forwardtech.com

Radio Frequency Sealing

Radio frequency (RF) uses heat, pressure and time to form a seal. The heat is generated from high-energy electromagnetic waves (27-31 MHz), which excite the molecules of the materials being bonded. The excitement of the molecules creates heat which combines with pressure and time to form an integral seal.

- RF sealing can only be used with plastics having the correct dielectric properties, such as PVC and acrylic.
- The most common method for RF sealing of microporous membranes is to encapsulate the membrane between two plastic housings.
- Longer seal times are preferred for better control of the sealing process.
- Avoid potential arcing, which can cause sealing failures.

For More Information

Radio Frequency Sealing

Callanan
Elk Grove, IL USA
847-364-4242

Mechanical Sealing

Membranes can be sealed in place by mechanical means, such as a filter support that is clamped in place using an O-ring or gasket or by insert molding the membrane into plastic components.

Insert Molding

In this technique the media is held in place or placed into a mold, while molten plastic is forced into the mold, forming an integral piece containing the membrane. Insert molding is a good choice for producing high volume/low cost components containing membranes.

- Minimal pinch force should be applied to prevent membrane damage.
- Avoid venting hot gases through the membrane.

For More Information

Insert Molding

Husky
Bolton, Ontario Canada
770-487-6234
www.huskyims.com

Krauss Maffel
Alach, Germany
www.krauss-maffel.de

Sandretto
Freedom, PA USA
724-775-4255
www.sandretto.net

Die Cutting and Slitting

If your operation includes die cutting and slitting of the media, here are a few guidelines to help you when considering your process.

- Conventional steel rule, rotary and impact dies work well with both unsupported and supported membranes.
- Male/female dies can be used with most supported and unsupported membranes.
- When cutting membranes, dies must be kept sharp with diametrical clearance maintained at 0.0003" or less.
- Dies should strike through the membrane to a hard surface. The use of interleafing layers may be necessary, depending on the membrane type.

For More Information

Die Cutting and Slitting

LTI Atlanta
Suwanee, GA USA
770-418-9005
www.ltiatlanta.com

Sealing Compatibility Guide

● Compatible
▲ Not Compatible

Housing	Method	Membrane										
		Glass Fiber	Ultipor® (Nylon 6,6)	Supor® R (Polyethersulfone)	Polypropylene	Emflon® (PTFE)	Supor (Polyethersulfone)	Versapor® (Acrylic Copolymer)	Versapor T (Acrylic Copolymer)	Versapor R (Acrylic Copolymer)	Versapor TR (Acrylic Copolymer)	Pallflex®
ABS	Adhesive Sealing	●	●	●	●	●	●	●	●	●	●	●
	Ultrasonic	▲	●	●	●	●	●	●	●	●	●	▲
	Heated Dies	●	●	●	●	●	●	●	●	●	●	●
	Radio Frequency	●	●	●	●	●	●	●	●	●	●	●
	Mechanical Seal	●	●	●	●	●	●	●	●	●	●	●
	Insert Molding	●	●	●	●	●	●	●	●	●	●	●
Acrylic	Adhesive Sealing	●	●	●	●	●	●	●	●	●	●	●
	Ultrasonic	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Heated Dies	●	●	●	●	●	●	●	●	●	●	●
	Radio Frequency	●	●	●	●	●	●	●	●	●	●	●
	Mechanical Seal	●	●	●	●	●	●	●	●	●	●	●
	Insert Molding	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
EVA	Adhesive Sealing	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Ultrasonic	▲	●	●	●	●	●	●	●	●	●	▲
	Heated Dies	●	●	●	●	●	●	●	●	●	●	●
	Radio Frequency	●	●	●	●	●	●	●	●	●	●	●
	Mechanical Seal	●	●	●	●	●	●	●	●	●	●	●
	Insert Molding	●	●	●	●	●	●	●	●	●	●	●
Latex	Adhesive Sealing	●	●	●	●	●	●	●	●	●	●	●
	Ultrasonic	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Heated Dies	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Radio Frequency	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Mechanical Seal	●	●	●	●	●	●	●	●	●	●	●
	Insert Molding	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Natural Rubber	Adhesive Sealing	●	●	●	●	●	●	●	●	●	●	●
	Ultrasonic	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Heated Dies	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Radio Frequency	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Mechanical Seal	●	●	●	●	●	●	●	●	●	●	●
	Insert Molding	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲

Sealing Compatibility Guide continued next page

Sealing Compatibility Guide, continued

● Compatible
▲ Not Compatible

Housing	Method	Membrane										
		Glass Fiber	Ultipor® (Nylon 6,6)	Supor® R (Polyethersulfone)	Polypropylene	Emflon® (PTFE)	Supor (Polyethersulfone)	Versapor® (Acrylic Copolymer)	Versapor T (Acrylic Copolymer)	Versapor R (Acrylic Copolymer)	Versapor TR (Acrylic Copolymer)	Pallflex®
Polycarbonate	Adhesive Sealing	●	●	●	●	●	●	●	●	●	●	●
	Ultrasonic	▲	●	●	●	●	●	●	●	●	●	▲
	Heated Dies	●	●	●	●	●	●	●	●	●	●	●
	Radio Frequency	●	●	●	●	●	●	●	●	●	●	●
	Mechanical Seal	●	●	●	●	●	●	●	●	●	●	●
	Insert Molding	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Polyester (PBT)	Adhesive Sealing	●	●	●	●	●	●	●	●	●	●	●
	Ultrasonic	●	●	●	●	●	●	●	●	●	●	▲
	Heated Dies	●	●	●	●	●	●	●	●	●	●	●
	Radio Frequency	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Mechanical Seal	●	●	●	●	●	●	●	●	●	●	●
	Insert Molding	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Polyethylene	Adhesive Sealing	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Ultrasonic	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Heated Dies	●	●	●	●	●	●	●	●	●	●	●
	Radio Frequency	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Mechanical Seal	●	●	●	●	●	●	●	●	●	●	●
	Insert Molding	●	●	●	●	●	●	●	●	●	●	●
Polypropylene	Adhesive Sealing	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Ultrasonic	▲	●	●	●	●	●	●	●	●	●	▲
	Heated Dies	●	●	●	●	●	●	●	●	●	●	●
	Radio Frequency	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Mechanical Seal	●	●	●	●	●	●	●	●	●	●	●
	Insert Molding	●	●	●	●	●	●	●	●	●	●	●
PVC	Adhesive Sealing	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Ultrasonic	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Heated Dies	●	●	●	●	●	●	●	●	●	●	●
	Radio Frequency	●	●	●	●	●	●	●	●	●	●	●
	Mechanical Seal	●	●	●	●	●	●	●	●	●	●	●
	Insert Molding	●	●	●	●	●	●	●	●	●	●	●

Sealing Compatibility Guide, continued

● Compatible
▲ Not Compatible

References Used

Handbook of Plastic Joining
Copyright 1997
Plastics Design Library

Modern Plastics Encyclopedia 99
The McGraw-Hill Companies

Housing	Method	Membrane										
		Glass Fiber	Ultipor® (Nylon 6,6)	Supor®R (Polyethersulfone)	Polypropylene	Emflon® (PTFE)	Supor (Polyethersulfone)	Versapor® (Acrylic Copolymer)	Versapor T (Acrylic Copolymer)	Versapor R (Acrylic Copolymer)	Versapor TR (Acrylic Copolymer)	Pallflex®
Silicone	Adhesive Sealing	●	●	●	●	●	●	●	●	●	●	●
	Ultrasonic	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Heated Dies	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Radio Frequency	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Mechanical Seal	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Insert Molding	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Styrene	Adhesive Sealing	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Ultrasonic	▲	●	●	●	●	●	●	●	●	●	▲
	Heated Dies	●	●	●	●	●	●	●	●	●	●	●
	Radio Frequency	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Mechanical Seal	●	●	●	●	●	●	●	●	●	●	●
	Insert Molding	●	●	●	●	●	●	●	●	●	●	●
Synthetic Rubber	Adhesive Sealing	●	●	●	●	●	●	●	●	●	●	●
	Ultrasonic	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Heated Dies	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Radio Frequency	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Mechanical Seal	●	●	●	●	●	●	●	●	●	●	●
	Insert Molding	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Urethane (thermoplastic)	Adhesive Sealing	●	●	●	●	●	●	●	●	●	●	●
	Ultrasonic	▲	●	●	●	●	●	●	●	●	●	▲
	Heated Dies	●	●	●	●	●	●	●	●	●	●	●
	Radio Frequency	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Mechanical Seal	●	●	●	●	●	●	●	●	●	●	●
	Insert Molding	●	●	●	●	●	●	●	●	●	●	●