Sealing Your Input Device

WHITE PAPER

Sealing Your Input Device
The Key to Longevity
Sealing Your Input Device: The Key To Longevity

All materials are permeable to some degree. Sealing, therefore, as defined by Advanced Input Systems is to prevent the egress into an enclosure or layers of a keypad by moisture, liquids, chemicals, or particles.

Nothing you can do will prolong the life of your input device more than the proper sealing solution by the above definition. Primary considerations are the environment in which the device will operate and the design of the product itself. Our command of manufacturing, design, material, and technology produces input devices for the most difficult sealing applications. An understanding of materials, environments, and products will help you make the right selection for your device. This publication describes our most common sealing solutions.

Gasketing

The sealing performance of a gasket material depends strongly on how it is designed and the environment in which it operates. Polymeric composites, like those used in gasketing and sealing applications, consist of polymers combined with fillers, fibers, rubber, and other materials manufactured on a calendar under high load. This produces a composite with interconnected pores. Most commonly, gasket applications include seals for water, air, gasses, and chemicals.

Materials can be formulated in a wide range of firmness and a variety of densities. Different materials are carefully engineered to create a seal in various fluids, operating temperatures, flange pressures, and mating surfaces. Material uniformity and consistency of physical properties are crucial when designing to tight tolerances.

Gasket material is typically supplied in continuous rolls. It is then easily die-cut, slit, milled, and laminated. The material can be furnished in ring and full-face flange gaskets as well as custom shapes. Gaskets are compatible with a variety of adhesives, allowing for flexibility in positioning.

Environmental considerations vary tremendously between applications. The most common concerns include compression set resistance, outgassing, chemical and solvent resistance,
high temperature load retention, low temperature flexibility, thermal conductivity, electrical characteristics, and coefficient of thermal expansion. Low outgassing and good resistance to many chemicals and solvents are the most common considerations when qualifying material for gasketing and sealing applications.

Most sealing or permeability tests use the same basic technique. The purpose is to measure the total quantity of fluid lost over the face and through the body of the gasket. Leakage rate is the quantity of fluid passing through the body and/or over the face of a gasket over a specified time. Working conditions such as media, pressure, temperature, and surface pressure profoundly influence leakage rate. For a given set of application circumstances, the lower the leakage rate, the better the gasket material retains the fluid.

Gasket pressure under operating conditions is a crucial design criterion to prevent unacceptable creep relaxation or failure of the gasket material. The limit on gasket compression is generally determined by the required sealing performance. The smaller the quantity of fluid lost with time, the better the sealability of the gasket material.

A few common gasket applications for input devices are as follows:

- A back mounted panel where the gasket is placed around the topside perimeter and seal is nestled between the enclosure and the unit. Used in a back mount design, the gasket can serve a dual purpose as well; one to seal and one to be an EMI barrier. EMI compatible material can be used when choosing the appropriate gasket material for your particular application.

- A top mounted panel set into a recess in a bezel so that the gasket is around the bottom to prevent leakage. As the gasket compresses with installation it seals the panel and prevents liquids from entering.

- A gasket can be designed to be placed around the middle of two mating surfaces such as plastic halves which when compressed in assembly seals the unit.

Adhesives

Pressure Sensitive Adhesives
Pressure Sensitive Adhesives (PSAs) are widely used for sealing input devices. PSAs are generally a layer of uncured acrylic adhesive that is laminated onto the surface of the keypad. When installed into the bezel, pressure and temperature combine to cure the adhesive. This adhesive acts as a physical barrier to a wide variety of liquids, chemicals, and particles. It is suitable for use in a wide range of temperatures and pressures.

Hot Melt Adhesives
Hot melt is designed to protect electronic circuitry and assemblies from potentially damaging conditions such as moisture, various corrosive chemicals, excessive heat, vibration, mechanical impact, thermal shocks and abrasion which might occur while the device is in operation.

Hot melt adhesives are applied in the molten state and then harden. The adhesive substance is melted and applied to the surfaces, which are then joined together. Once the adhesive cools and solidifies, the joint and seal are complete. For seal enhancement, a thermal formed plastic sheet can act as an encapsulate over the hot melt which forces the necessary encasement of components and achieves a submersible level of sealing. Hot melt can act as an electrically conductive adhesive, a sealant, and a coating — or a combination of all three.

Given the right composite, a circuit board can be submersible without concern for the functionality of the components. This, of course, depends on temperature and viscosity.

Other Sealing Technologies

Elastomeric Sealing Bump or Rib
One commonly used technique in a mid travel, back mount silicone elastomer keypad is to groove the elastomer tool so as to create tapered sealing ribs or protruding bumps along the outside perimeter of the keys. Once the elastomer keypad is back mounted into an enclosure, the ribs compress and thus prevent liquid from entering the console. Assembly of components joins the two to prevent leakage. The seal is formed between the ribs and the torque load from the back mounted bezel to achieve the desired level of sealing under the operating conditions.
Silicone RTV
Silicone RTV (room temperature vulcanizing) is similar to common household bathroom caulking. Silicone RTV is generally applied to exposed edges or around the perimeter of a keypad. RTV can accommodate significant variations in surface flatness and geometries. Selection of a silicone RTV (or similar two-part epoxy) is dependent on the material onto which it is applied.

Ultrasonic Welding
Ultrasonic welding is a method of sealing certain plastics by the use of high-energy sound waves. These sound waves vibrate specially designed “energy directors”, causing localized melting of the plastic. A liquid-tight seal is produced when the plastic re-solidifies.

Conformal Coatings
A conformal coating is a liquid or gaseous chemical that is applied to “coat” an area or object. When it solidifies, it prevents exposure to environmental contaminants. There are two categories of conformal coating – resin and paraxylylene. Resins include four different materials: polyurethane, acrylic, silicone, and epoxide. Paraxylylene, referred to as parylene, is a gaseous chemical that is vacuum deposited to objects. It is typically applied in much thinner layers than resins. It is highly resistant to moisture and chemicals, especially organic solvents. Due to the manner in which it is deposited and its physical characteristics, parylene is a thin film on top of the object rather than a covering which flows around it. The coating used is entirely dependent on the application of the unit and type of environment from which you are protecting the device.

For high performance, low cost sealing solutions or sealability data, contact Advanced Input Systems’ experienced design team. They can help you match your concepts and technical requirements with the best sealing solution for your specific application.

For more information, call 1-800-444-5923 or visit www.advanced-input.com

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Common Sealing Solutions

▲ Pressure Sensitive Adhesive (PSA) With a Top Mounted Keypad

▲ Back Mount With Gasket

▲ Ultrasonic Welded Enclosure

▲ Keypad Sealed Using Silicone RTV (Room Temperature Vulcanizing)

▲ Elastomer With Seal Bumps

We make the input devices that control the OEM products that operate the world.
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### Sealing Technologies

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