

# Battery Sealing Strategies

Hermetic epoxies seals protect lithium-based batteries

Whether they take to the streets in electric vehicles or stand still in energy storage systems, lithium-based battery modules pose a tough challenge from a wire sealing standpoint. Modern battery modules have a variety of power and signal conductors running between their individual electrochemical cells and through the battery pack's exterior casing. Some or all of these conductors typically require hermetic feedthroughs to protect against contaminants, humidity and leakage.

For safety reasons, these feedthroughs have to be absolutely dependable—even when subject to recurring shock-and-vibration loads, temperature extremes and potentially corrosive electrolytes.

Increasingly, battery makers are looking to epoxy-based feedthroughs as an alternative to glass-to-metal seals. Epoxies have a unique balance of mechanical, electrical, thermal and chemical-resistance properties that make them a good fit for battery sealing applications.

## StudSeal For Power

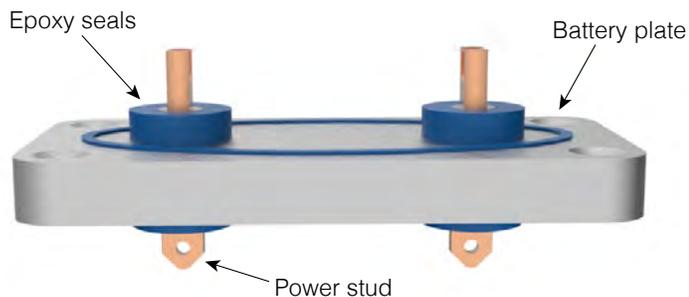
Our StudSeal™ hermetic feedthroughs are used in a variety of vacuum or pressure applications where high current or high voltages penetrate a barrier. StudSeal passes about 80 Amps through an internal gas filled casing that surrounds the individual electrochemical cells. Hermetically sealed to  $1 \times 10^{-8}$  cm<sup>3</sup> He/sec and pressurized, the internal casing primarily protects the battery from external humidity and ensures an ideal operating environment.

The epoxy formulations used in StudSeal feedthroughs have passed compatibility testing with traditional electrolyte battery chemistry. And these formulations are also compatible with a long list of potentially corrosive chemicals—including brake fluid, engine oil, road salt, solvents, gasoline and diesel. More importantly in this application, StudSeal epoxies also tolerate and block the flow of inert gases.

We take care of the entire StudSeal assembly operation in our shop. The battery manufacturer ships the housing blank to us, and we handle the epoxy application that permanently bonds the StudSeal to the casing while sealing it to hermetic standards.



### Power Feedthrough



potting these standard connectors, we can take advantage of the low cost and design flexibility of standard connectors without sacrificing hermetic performance.

Delivering both the electrical and hermetic performance required careful formulation of the epoxy—which had to strike a delicate balance between electrical, mechanical and flow properties. And the complexity of this electrically-isolating feedthrough design involved the development of a new manufacturing process.

### CircuitSeal For Signal

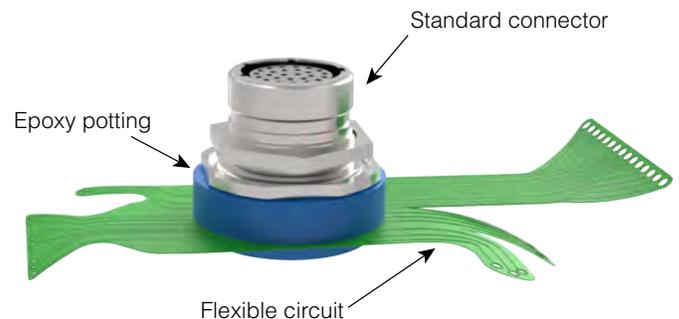
Battery systems also require condition monitoring signals—such as temperature and voltage—to pass through the sealed battery container. That's where our CircuitSeal™ technology comes in.

CircuitSeal uses epoxies and proprietary manufacturing techniques to hermetically seal and integrate printed circuit boards and connectors, creating a feedthrough assembly that saves space and weight while supporting high conductor densities.

We make CircuitSeals every day, but designs for battery applications need extra attention due to the inert gas environment in the battery housing.

So we created a CircuitSeal design that uses an additional cap layer of epoxy potting material to provide electrical isolation. These back-potting operations are increasingly common for us, since we often need to work with off-the-shelf connectors that do not offer hermetic performance. By back-

### Signal Feedthrough



But the results have paid off in battery applications. This CircuitSeal meets the hermetic performance requirements of  $1 \times 10^{-8}$  cm<sup>3</sup> He/sec while readily withstanding the necessary voltages.

**For more information on hermetic wire and feedthrough technologies, visit [www.douglaselectrical.com](http://www.douglaselectrical.com)**