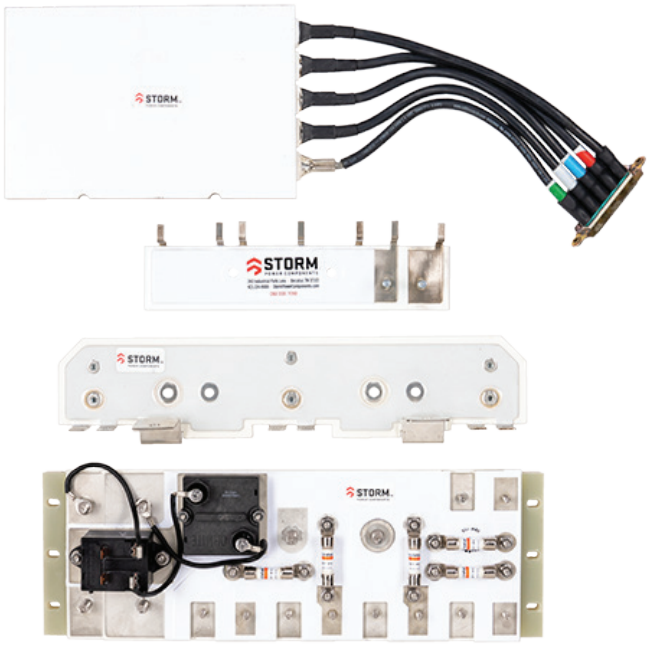
STORM POWER COMPONENTS

Applications Note

Best Practices for Edge Conditioning and Sealing of Laminated Busbar Assemblies

Laminated busbars consist of multiple conductive metal layers, typically copper or aluminum, that are separated by paper-thin layers of dielectric material. The multi-layer assembly is then heated and compressed to form a robust integrated component.

The laminated busbar approach offers several advantages over single layer busbars or cables, including more efficiency, higher reliability, reduced heat, lower inductance, and overall cleaner power. Laminated busbars also offer better options for vertical integration of components to integrate complex functionality into custom assemblies.



Properly sealing the edges on a laminated busbar is crucial for several reasons:

- **Safety:** It shields the conductors from FOD (ie. dropped washers that could cause a failure) and is safer for things that could touch the part like people, cables, and nearby components.
- **Environmental:** Sealing the edges protects the busbar from environmental factors like moisture, dust, or contamination.
- **Enhancing Electrical Performance:** Sealing helps in maintaining the electrical properties of the busbar, while also improving creepage and clearance.
- **Improving Mechanical Strength:** Sealing also contributes to the mechanical strength of the busbar assembly, providing additional support and protection against physical damage.

Applications Note:
Edge Conditioning and Sealing Methods for Laminated Busbars

There are four primary methodologies for dealing with edge conditioning for laminated busbars: Open Edge, Pinch Sealed, FR4, and Epoxy Edge-Filled.

Storm Power designers have created the sample part shown below that combines the four approaches, one method per edge. (Contact your Storm Power sales person for more information on these samples.)

Open Edge: (shown at top)
This is the least costly alternative because it essentially calls for doing no conditioning of the edges. However, it is only appropriate for busbars that will be deployed in clean environments. It is also inherently fragile so careful handling is important to avoid damage by tools or other parts.

Pinch Sealed: (shown at bottom)
This is more robust than open edge and is suitable for a wide range of environments. The process cost is not significantly more but there are one time NRE costs for creating the molding fixture. Pinch sealing also requires a minimum 2X conductor thickness overlap.

FR4: (shown at right side)
FR4 is higher cost than Pinch Seal, but could balance out because no NRE for a molding fixture is required. FR4 can be designed for all environments and is more robust than Open Edge or Pinch Seal. It also requires 2X conductor thickness overlap.

Epoxy Edge Filled: (shown at left side)
This is the highest cost option but it can be used for virtually any environment and requires a small overlap of only .04" to .06".

FR4 is the most mechanically robust but epoxy is more hermetically sealed and impervious to moisture

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Summary

The table below provides a brief recap of the advantages, costs and tradeoffs for each edge conditioning approach

Method	Advantages	Costs	Tradeoffs
Open Edge	Simple design, lowest manufacturing costs.	Lowest cost. Similar unit cost as Pinch Sealing but lower tooling cost.	Exposes edges to contamination and is most susceptible to damage.
Pinch Sealing	Low-cost, can be automated, provides a solid mechanical seal.	Moderate cost. Similar unit cost as Open but increased tooling cost.	Requires adequate space and is geometry dependent.
FR4	High insulation, mechanical strength, heat resistance.	Higher cost due to added components.	May require additional sealing depending on environmental factors.
Epoxy Edge Filled	Smallest footprint and good environmental protection.	Highest cost option.	Manual and time consuming, not large volume friendly.

At Storm Power Components, our engineering teams have decades of experience with designing complex busbars that have proven reliable in the most demanding of deployments. This is because we always start with the end goal of the system in mind and then bring our knowledge, experience, and creativity together in a holistic manner to achieve those goals.

This is particularly important when making key decisions between alternatives for edge conditioning and sealing, where making a sub-optimal choice can drive up the cost or expose the system to risk of failure.