



Faraday Bicycles

Die-cut components

CASE STUDY

The challenge

When Faraday Bicycles was developing their electric commuter bicycle, they asked GM Nameplate (GMN) to help find a die-cut solution to seal their bike's electronic component box. Faraday makes premium quality electric bikes, or e-bikes, with comfort, aesthetics, and performance serving as their highest priorities. Their bike has a box that sits below the saddle and contains the electronic components that enable the bike to assist riders while pedaling. Since the box plays an instrumental role in the operation of the bike, Faraday needed to make sure it was protected.

Faraday had multiple requirements that the die-cut solution needed to fulfill. First, Faraday wanted to design the bike to be able to handle all weather conditions. They also needed to prevent the electronic components from vibrating or getting damaged while the bike was being ridden. Finally, they were looking for a solution that was strong enough to survive the life of the e-bike, as well as restrict access to the box to ensure that the electronics couldn't be tampered with or modified.

Project goals

- **Protect the electronics box of the bike from water and rain.**
- **Reduce the vibration of the internal electronic components.**
- **Safeguard the electronics from being tampered with or modified to protect bike users.**

The solution

Electric bikes are made to assist the rider with pedaling. This capability can be incredibly helpful for commuting cyclists who face hills frequently. However, since the weather isn't always sunny and dry, it was essential for Faraday to design their electric bike to be rideable in the rain. This was especially important for cities like Seattle or Portland, where it rains

frequently. Therefore, Faraday called on GMN to find a solution that would seal their bike's electronics box to prevent any moisture or liquids from getting in.

There were two main requirements for the sealant of the electronic component box: waterproofing and securing the components. The box needed to be completely watertight, which meant mechanical fasteners were out of the question, as they can rust and allow water to seep through. Several die-cut foam adhesives would have satisfied the waterproofing condition, but they weren't strong enough to effectively secure the box. Faraday needed an adhesive that provided a strong enough adherence to ensure that the electronic component box couldn't be removed after it was placed on the bike. If the box could be accessed, the components could be tampered with to make the bike unsafe. Similar to the intention of most smartphones, the box was meant to be used and not meant to be taken apart. Again, die-cut adhesives were a better option for this requirement than mechanical fasteners, such as screws, because then the box could easily be accessed by simply using a screwdriver. However, it was important to carefully select which specific adhesive to use for this application since not all adhesives are powerful enough to resist someone prying and pulling at them.

Another issue that arose during the material selection process was that the perimeter of the component box was powder-coated. Powder-coated surfaces have a low-surface energy, which means they have a weak molecular attraction. This causes standard adhesives to not stick as well, compared to high surface energy substrates. This made it difficult for foams and gaskets to properly adhere to the sides of the box.

With these criteria in mind, GMN recommend the use of die-cut 3M VHB (very high bond) adhesive. VHB is commonly employed when strength and durability is needed and to take the place of liquid adhesives and mechanical fasteners. It is also particularly well-known for its waterproofing abilities and is compatible with most substrates no matter the surface energy level. However, VHB works best when the surface is dry and flat. Therefore, in order to be able to use the VHB, GMN and Faraday worked side-by-side during the design

Attributes of VHB

- ✓ **STRONG BOND**
- ✓ **WATERPROOF**
- ✓ **LIGHTWEIGHT**



process of the electronic component box to incorporate flat surfaces. The VHB adhesive created a watertight seal for the electronic component box, and provided a long-term durable bond that would maintain its strength and secure the box for up to 35 years, regardless of outdoor conditions. After helping design the dimensions of the box, GMN die-cut four VHB gaskets in custom shapes to seal the box.

6 FOAM COMPONENTS

4 gaskets

2 dampening squares

The VHB gaskets guaranteed that the electronic components would remain dry and safe from water damage and that the box could not be accessed. However, Faraday also needed the electronics to ride softly in the bike so that the components wouldn't vibrate or get damaged

when traveling on uneven surfaces. GMN solved this by die-cutting two VHB square foam pieces to place inside of the component box. These foam pieces would provide a cushion between the inside surface of the box and the electronic components. This allowed bicycle owners to be able to ride smoothly without much shaking or vibration from the box.

GMN's ability to address Faraday's sealing issues efficiently and effectively allowed them to move into production on time, while meeting all of their requirements. With over 60 years of manufacturing experience, GMN's knowledge and expertise on materials help us find the best solution for our customers. GMN's die-cutting capabilities can solve specific problems within products such as sound dampening, EMI/RFI shielding, electrical insulation, thermal management, bonding, gap filling, sealing, air flow, and overheating. As a preferred converter for 3M, Rogers Corporation, and Laird Technologies, GMN can fabricate and deliver high-quality materials to our customers faster and more affordably. With our extensive converting expertise, we can provide fabrication, material, and design suggestions for your next project.

