

Coffin-Manson Fuse Coupons: DOE to Refine Reliability Model*

Purpose:

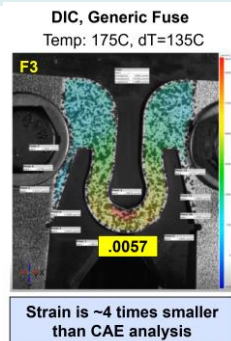
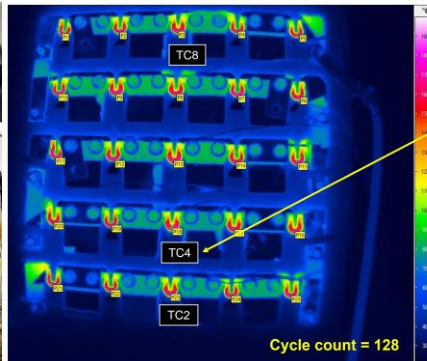
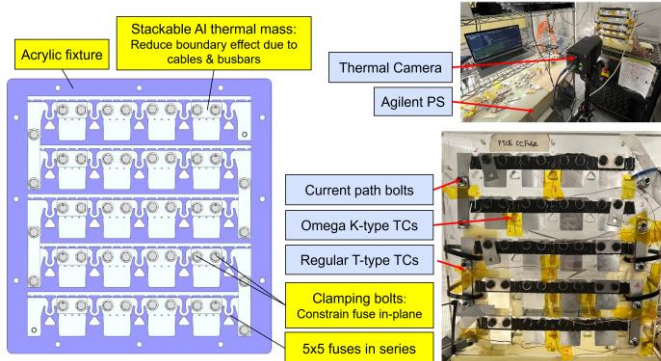
- To accurately predict current collector fuse durability through experiment

Solution:

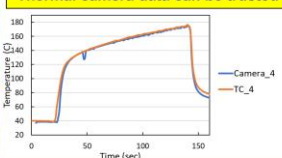
- Designed a fuse coupon that reduced peak temperature variation from 20C+ to < 3C
- Proved that thermal camera data is trustworthy
- Troubleshoot slow fuse failure using DIC strain measurement

Results:

- Reduced 88% of TCs needed and saved 80% of instrumentation cost
- Through DIC, determined that >1mm buckling was the cause of slow failure. Designed 2nd iteration of coupons to constrain out-of-plane motion



Thermal camera data matches with TC:
Thermal camera data can be trusted



Even peak temperature spread:
TC readings are representative

Peak Temp Distribution (C)	
Range	10.07
Variance	8.66
SD	2.94
Average	176.18

*The content above was reviewed and approved by Tesla, Inc. for disclosure.

Pouch Cell Module: Design for Integration

Purpose:

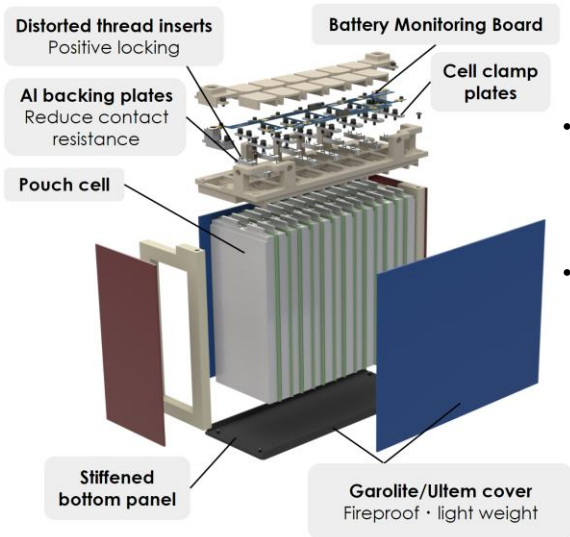
- To make reliable electrical contact
- To improve the serviceability of BMB

Solution:

- Separated BMB bolts from cell connections
- Replaced safety wire with distorted thread inserts to positively lock cell connections
- Raised Al backing plates from plastic cover to ensure electrical contact
- Used torque specs

Results:

- Reduced contact resistance by 23% at a torque spec of 1.4 Nm
- Accelerated manufacturing timeline by 25%
- Reduced module integration time from 3 months to 1 day



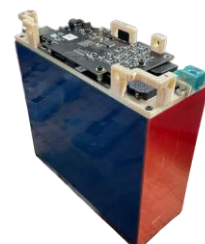
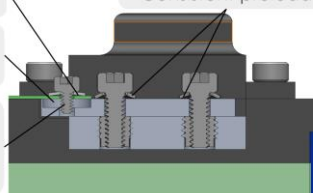
Battery Monitoring Board
Partially flexible

Oversized Counterbore
Fitting thermistors

Board mount hole
Separated from cell connection to increase maintainability



Belleville Washers
Consistent preload

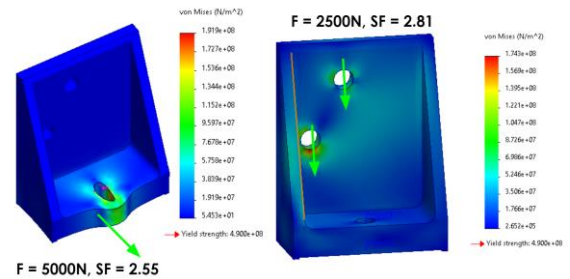


Battery Mounting Bracket: Design for Manufacturing

REV7's bracket



REV8's bracket



Purpose:

- To mount a 117-lb battery pack to the chassis
- To make it easy to machine in-house
- Strong enough to withstand 40g lateral & 20g vertical acceleration

Solution:

- Separated 1 bracket into 2 to improve manufacturability
- Simplified gusset design for CNC machining
- Sized fasteners on chassis mount & skin interface
- Analyzed loads on brackets

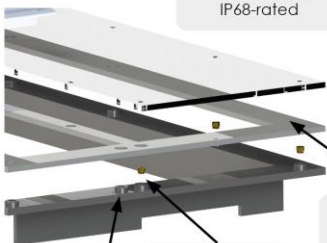
Results:

- Reduced machining time by 33% from the previous version
- Able to withstand required loads
- Reduced weight by 0.7 lb

Penthouse: Accessible & Waterproof Enclosure



Cable Glands
IP68-rated



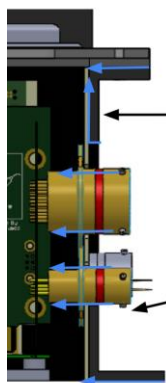
Ultem Flanges
75% Compression limiters

Press fit Insert

Neoprene Foam Gasket

Solution:

- Separated HVD housing from the lid
- Used captive fasteners
- Put a wrench in CAD for each bolted joint
- Conducted 14+ enclosure-level rain tests to find leaks

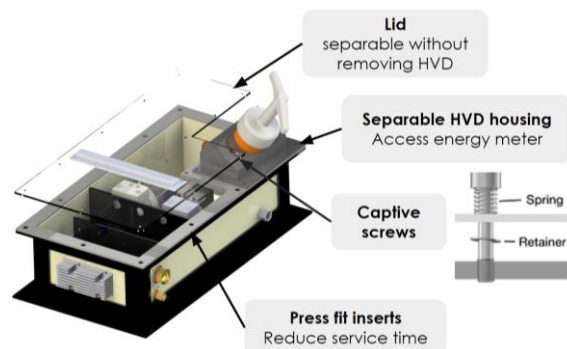


Leak through gaps between flanges & walls

Solution: Sealant along flanges

Gap between panel & autosport connectors

Solution: Gasket under autosport flange



Results:

- Passed rain test at FSAE competition
- Reduced integration time from 3 months to 2 weeks



Purpose:

- To increase the accessibility of an HV enclosure that contains BMS & electronics
- To ensure water resistance