

# Battery Safety: Protections at All Levels



Battery packs are the energy storage devices that get you from A to B. Just like a gas tank or a CNG cylinder, batteries need to be safe, both in daily use and in the event of an accident. The batteries we use in our vehicles have many layers of safety features built right in.

## Cell Level Safety Features

- **NMC technology cells** are commonly used in passenger EVs.
- **Venting** eliminates the chance of pressure build-up.
- **Positive Temperature Coefficient component** limits electric current if it rises above nominal range.

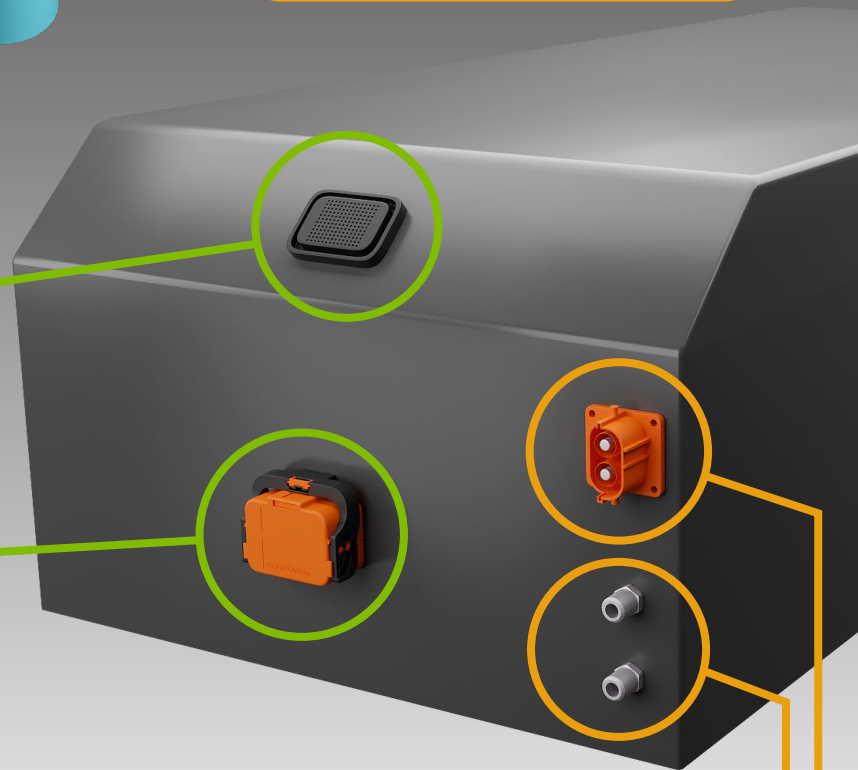


## Module Level Safety Features

- **Fusible connections** will disconnect individual cells if their current gets too high.
- **Containment regions** restrict thermal runaway events to small groups of cells.

## Pack Level Safety Features

- **Main contactors** connect the high voltage to the cables only when the vehicle is ON or being charged.
- **Waterproof vent system** eliminates the chance of gases building up.
- **Battery Management System (BMS)** prevents over-charging and over-depletion.
- **BMS** opens the main contactors if an over-current situation occurs, shutting the pack down.
- **Manual Service Disconnect (MSD)** ensures safe battery isolation during servicing.
- **Strong steel case** ensures safety in on-road use and reduces risk during accidents.



## Mounting Safety Features

- **Mounting design is computationally modeled** to eliminate yielding and fatigue under expected long-term road use.

## System Level Safety Features

- **Thermal management system** maintains the batteries in their optimum temperature range.
- **High Voltage Interlock Loop (HVIL)** constantly monitors the integrity of all high voltage components and connections, and instantly opens the main contactors if there's a problem.

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