Suppose your responsibility is testing electric vehicle (EV) batteries. In that case, you are contending with increasing production volumes to address market growth and higher kilowatt-hour capacity battery packs to extend driving distance. You also must have test capability for testing higher voltage battery packs, enabling vehicles to use smaller gauge wiring for weight reduction.

Suppose you also must test battery packs for off-road vehicles. In that case, you have the added challenge of verifying that battery packs can safely withstand the additional mechanical stresses due to operation on rough terrain and exposure to heavy loads.

Battery test systems need to accommodate battery voltages evolving from 400 V to 800 V and higher. In addition, battery capacities are increasing to over 100 kWh. Furthermore, off-road battery packs require vibration and shock testing. EA Elektro-Automatik (EA) has the DC programmable power solutions for all these requirements. We will recommend test requirements and introduce test instruments and systems to address all the challenges of off-road EV battery pack testing.

**Recommended tests for off-road EV battery testing**

Determining that batteries meet their specifications for deployment in off-road vehicles includes tests that all EV battery packs should pass and some tests specific to off-road vehicles. These tests are:

* **DC internal resistance** – A measurement of internal resistance assesses the battery’s state-of-health (SOH) and capacity to deliver a load current at a specific voltage.
* **Insulation resistance** – A lower than the specified Insulation resistance, determined from a leakage current measurement, results in reduced battery efficiency and can compromise safety.
* **Pulse testing** – Generating high current, short duration pulse loads determines how well the battery can dissipate heat during high power demand and absorption conditions. Pulse tests simulate rapid acceleration and regenerative braking conditions. This stress test evaluates the state-of-charge (SoC) indicative of drive distance or usage time between charges.
* **Drive cycle simulation** – Varying the load profile according to standard drive simulation tests, such as Federal Test Procedure, FTP-75, provides a standard for comparison of battery performance and vehicle driving distance.

## Why Fuel Cell Testing Is Crucial

Testing solutions allow you to evaluate the operational characteristics of fuel cell technology. Through comprehensive testing, you can verify that every single cell operates safely under different conditions, including high temperatures and extreme back pressures. It also ensures compliance with laws and industry standards, which is crucial for consumer confidence and market approval.

Additionally, testing services enable you to better understand the longevity and efficiency of a fuel cell stack. You can identify degradation mechanisms and the impact of numerous operating conditions on product lifespan. In turn, you’ll be able to use these insights to implement targeted changes and improve your design’s quality.

**Key Considerations for Fuel Cell Testing**

There are several types of[fuel cells](https://www.eapowered.com/industries/fuel-cells/), each with unique characteristics and testing requirements:

* **Proton Exchange Membrane Fuel Cells (PEMFCs):** Commonly used in transportation and require tests for rapid startup and dynamic load changes
* **Solid Oxide Fuel Cells (SOFCs):**Need high-temperature testing and durability assessments under thermal cycling
* **Alkaline Fuel Cells (AFCs):**Require tests for purity of hydrogen and oxygen to prevent contamination
* **Phosphoric Acid Fuel Cells (PAFCs):**Suitable for large-scale stationary applications requiring efficiency and heat recovery testing
* The best fuel cell test systems are capable of meeting the testing needs of multiple types of cells. For instance, EA Powered provides dynamic testing equipment that allows you to test a wide range of variables, including cell voltage, conductivity, energy storage, power range, flow control, humidification, and more.
* Now, it’s helpful to take a closer look at some of the common challenges in fuel cell testing, all of which our testing and simulation equipment helps you solve.