# SAFETY CRITICAL BATTERY TESTING

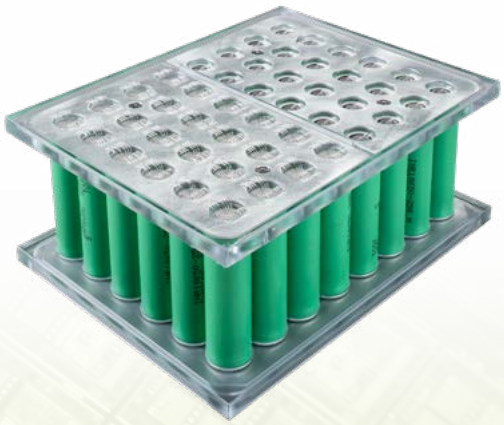
Application Note

**Battery lifetime and stability are of key importance for developing the next generation of electric cars. The automotive sector is booming in relation to electric vehicles with some manufacturers already having well-established electric cars on the market today. The reliability of these vehicles depends on overcoming the technical challenges around battery life-time, and ensuring it can match that of the components established in a combustion engine, which is typically around 10 years. Therefore, accurate testing of battery wire bonds is critical to guarantee long component lifetimes.**

## The Problem

In order to match the power outputs required by highly desirable fully-electric or hybrid supercars, batteries need to be energy-dense with high powered connections that are as reliable as the fuel system in a conventional combustion engine. To repeatedly charge and discharge high currents over time, the formation of multiple heavy gauge wire bonds, laser-welded tabs or capacitive-welded rods between individual cells, need to be carefully controlled to ensure high quality. The physically bonded area (opposed to the contact area) is the source of weakness for high-power connections; these are best characterized using an independent area measurement to regulate a true measure of adhesion and reliability.

This application easily becomes safety-critical so quality control and high supply standards are necessary. Non-destructive inspection techniques are often used for fast problem detection and quality assurance; however, this is not always possible due to the awkward shapes, materials, sizes and weights of battery packs. Destructive mechanical testing of these bonds usually involves peel, shear or pull testing.



A typical Ni cathode Li-ion rechargeable cell with multiple wire bonds, found in an automotive battery pack.

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## Our Solution

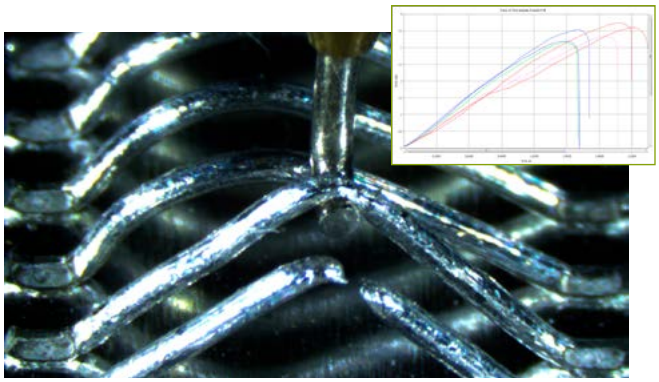
Nordson DAGE's 4600 Battery Bondtester is configured for high throughput testing of heavy gauge wire bonds or battery tab welds, up to forces of 20-100kg. The high precision linear encoded stage delivers superior accuracy so automated software test routines can be employed. The DAGE system is capable of both pull and shear modes and can easily switch between both, depending on which failure mode is being investigated, see right.

We characterize the battery connections in 2 modes:

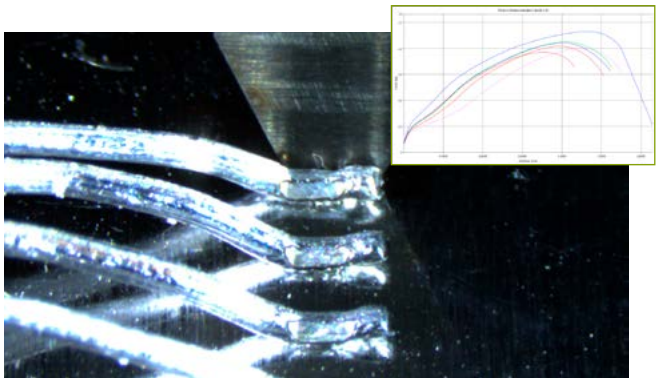
- **Destructive testing** - for new product development to characterize new welds or bond processes
- **Non-destructive testing** - for safety assurance by testing 100% of connections, before use in a final product

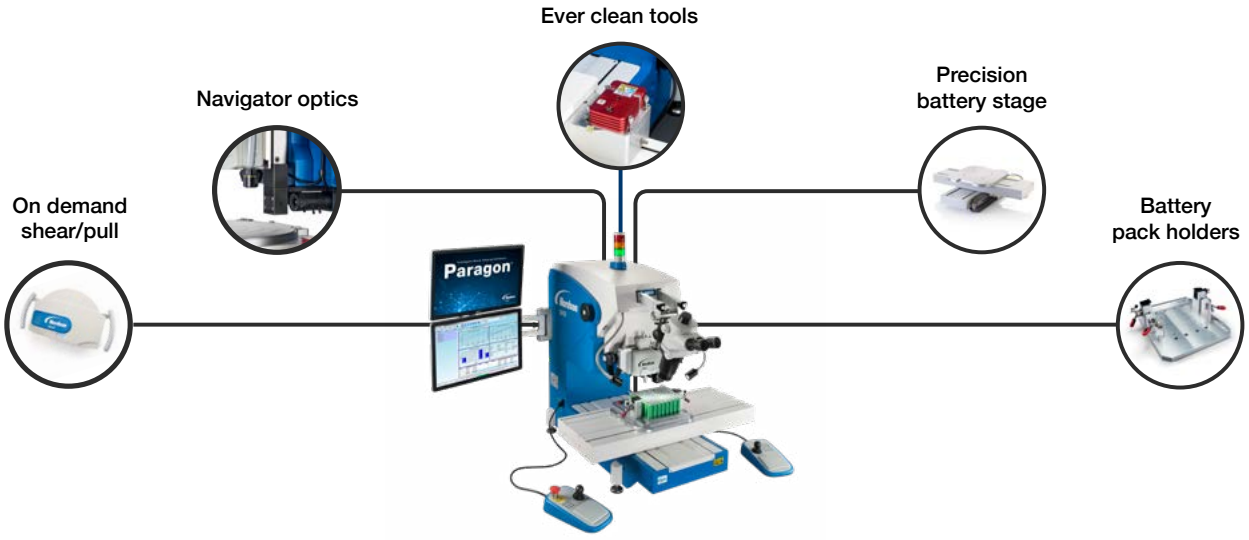
The optimized Bondtester configuration is shown below and includes

- Customized battery work holder
- Debris removal station
- Wide field of view optics
- Pull/shear multifunction cartridge
- Paragon automation software



Heavy gauge wire 0.5mm diameter wire bonds prior to shear and pull testing, inset shows typical forces recorded.







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