Battery Test Safety Requirements

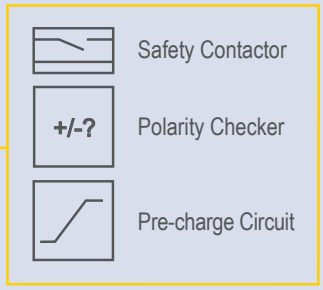
Safety is Paramount in Battery Testing

When testing batteries which are hazardous by nature, safety should be a major part of your battery test set-up. The details of safety requirements are often something customers think about after purchasing the test equipment. As a result, engineers end up having to integrate external fixtures and control mechanisms, adding to the complexity and cost of their system as well as schedule delays.

In this article, we'll share three safety features that should be at the top of your list at a minimum when looking for a battery test solution.

NHR's Battery Cycler

NHR Battery Cycler



NHR's Battery Cycler Includes Safety Contactor, Polarity Checker, and Pre-Charge Circuit.

Minimum Battery Test Safety Requirements

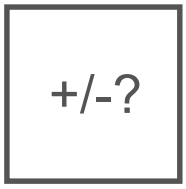
Important safety features include safety contactors, a reverse polarity checker, and a pre-charge circuit which are crucial for testing batteries safely and effectively. Neglecting to have any one of these in place will leave your battery test set-up vulnerable. Bi-directional power supplies and many battery cyclers do not include the following features, and lack thereof can lead to catastrophic events, UUT damage, and down-time.

1 Safety Contactors: Ensures Isolation and Safe "Off" Condition

Safety contactors are needed for isolation to create a safe "off" condition. A safety contactor provides isolation between your power source and the UUT (battery). When your battery cycler is off, a safety contactor provides the physical isolation to ensure there is no power flow from the cycler to the DUT. Without the contactor, even in an off state, power flow could still occur with your DUT. In most cases, if the hardware is still physically connected to the battery, there may be enough resistance created between those terminals that the power source will continue to draw current and drain the battery, or cause other safety hazards.

NHR uses a built-in hermetically sealed safety contactor that is designed into the test equipment. When our test systems are off, our instruments do not draw power and the contactor physically breaks the connection between the cycler and the UUT.

2 Polarity Checker: Protects Operator and Equipment from User Error



A polarity checker is necessary to prevent damage to the battery and the equipment in the case of incorrect wiring by the user, which happens quite frequently. A built-in reverse polarity checker prevents inadvertent damage by disabling output power when a negative voltage is detected at the output terminals.

For example, if the instrument were to detect a reverse polarity, the instrument will prevent the safety contactor from closing. This prevents a customer from accidentally reversing a battery, and then trying to charge or discharge it, which is extremely hazardous. Accidents such as this could also damage the instrument and/or cause a fire or explosion.

NHR includes a built-in reverse polarity checker, which provides the ability to ensure proper voltage at its output terminals.

3 Pre-Charge Checker Circuit: Reduces Inrush Current and Prevents Early Degradation of Hardware

Lastly, the built-in pre-charge circuit is significant to prevent inrush current and stress onto the system, which is dangerous to the battery cycler and the UUT components equally. This inrush is due to the output capacitance of the test equipment which can be detrimental to the UUT when it is connected and not at the same voltage level. A pre-charge circuit matches the internal voltage of the instrument to the battery, preventing arcs and large inrushes of current onto the system.

For example, if you are using a DC source, DC load or bi-directional instrument to test a 600 V battery, the instrument initially starts at 0 V (zero potential). Since these source/load instruments do not contain a pre-charge circuit, the moment the wires from your instrument are connected to the battery, you're completing that path and in turn, applying 600 volts to the instrument. This instantaneous connection results in an inrush current. This large difference in voltage levels is the cause of the inrush as the instrument's output capacitors are charged. This usually leads to early degradation of the relays and switches. A pre-charge works together with the safety contactors by matching the instrument's output voltage to the battery before the safety contactor closes.

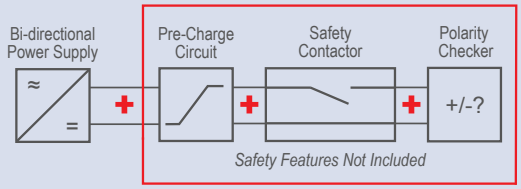
NHR's battery test systems have a built-in pre-charge circuit which provides a "soft start" that automatically matches the voltage on the DC output to the battery voltage.

Add-On Costs of Safety Features

Bi-directional power supplies and some battery cyclers on the market don't have the safety contactors, polarity checker or pre-charge circuits built into their test systems. These safety features are still required in order to use the equipment safely. As a result, manufacturers put the responsibility on the end customer to manage their own external fixturing, from sourcing components to integrating them with the solution. Some manufacturers may offer this integration as an added service, but also at an added cost.

- Requires additional labor & fees
- Increases set up complexity
- Quality & integration issues
- Delays project start time
- Performance & accuracy issues
- Takes up larger rack space
- External contactors & detection circuits take more time to open or close, slowing test time

Hidden Costs of Add Ons



Bi-directional power supplies and some battery cyclers require additional integration and set-up.

NHR Battery Test Systems Have Multiple Layers of Safety Built-In

When looking for a battery test solution, ask if these safety features are designed into the test equipment or integrated as an add-on service.

At NHR, we eliminate the pain and added costs of implementing safety by designing it into the system. All of these safety mechanisms are controlled through our soft touch panel, remote touch panel, and drivers such as LabView.

In addition to safety contactors, polarity checkers and pre-charge circuits, we also have multiple layers of hardware and software protection as shown in *Figure 1*. All of these safety mechanisms are controlled and fully integrated into the automation system, providing full safety control throughout the test environment.

For more information, contact NH Research at sales@nhresearch.com.

Want More Safety?

NHR Additional Safety Features

- Emergency power off (EPO)
- External wired interlock
- Programmable H/W limits
- Communication watchdog
- In-sequence logic (S/W)
- Additional monitoring (S/W)

Figure 1: *NHR Battery Test Systems have multiple layers of safety built-in.*

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