Batteries and repair

Three Factors to EV Shop Success

1. Equipment
2. Training
3. Safety

Equipment

Fluke 1587 FC Insulation Multimeter

4.9 (28) Write a review

Key features

- Safety first. Connect the insulation tester then keep yourself out of harm's way by monitoring your test measurements remotely.
- Prove your job is done right by quickly seeing and sharing insulation resistance test results wirelessly with your smartphone.
- Quickly find problems by saving and comparing measurements over time on a wireless device.

Equipment

Roll over image to zoom.

Product Image Feedback

EXTECH

Precision Milli Ohm Meter: 20 miliohm to 20 kilohm, +/-0.2% Accuracy, 10uA to 1A, LED

Item # **1XU20**
Mfr. Model # **380560**
UNSPSC # **41113631**
Catalog Page # **553**

Country of Origin Taiwan. Country of Origin is subject to change.

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Equipment

Mohawk Lifts > Browse Vehicle Lifts > Specialty Items > ST 2000 Scissor Lifting Table

ST 2000 Scissor Lifting Table

2,000lb Capacity Lifting Table

This lift table handles power train components like engines and their transmissions, engines with transaxle assemblies, rear ends and large electric vehicle batteries. It will also serve as a work table where components can be lowered to a convenient work height for repairs.

Equipment

xMB-9640

High-Voltage Module Balancer

xMB-9640 High-Voltage Module Balancer represents the third generation of Midtronics EV battery service tools, enabling technicians to quickly, efficiently and safely perform module-level balancing of EV and HEV batteries.

- Balances battery pack modules to ensure optimal pack operation, safely and efficiently charging or discharging individual modules to bring the pack into alignment and enable a better customer experience
- Easy user interface and on-screen prompts guide accurate service
- Compact footprint for more mobility within the shop

Safety Typical Cell Specs

Cell Specs

Nominal capacity: 2600mAh.

Minimum capacity: 2500mAh.

Nominal voltage: 3.65V.

Standard charge current: 1250mA (0.5C)

Maximum charge current: 2500mA (1C)

Charge voltage: 4.2V.

Charge cut-off current: 50mA.

Standard discharge: 500mA (0.2C)

Safety Cell Balancing

When you need several cells grouped together to power a device, you need to do some sought of balancing. The reason is that battery cells are fragile things that die or get damaged if they are charged or discharged too much. For your cells that have different SoC and you start using them, their voltage starts dropping until the cell with the least amount of energy stored in it reaches the discharge cut off voltage of the cell.

At that point, if the energy keeps flowing through the cell, it gets damaged beyond repair. Now, if you attempt to charge this group of cells to the correct combined voltage, the healthy cells get overcharged and thus get damaged as they will take the energy that the already dead cell is no longer able to store. Imbalanced lithium-ion cells die the first time you try to use them. This is why balancing is absolutely required.

Safety Thermal Runaway

Thermal Runaway

Battery cells, especially lithium cells are very sensitive to overcharging and over-discharging. This leads to thermal runaway when the rate of internal heat generation exceeds the rate at which the heat can be released. By the use of cell balancing, every non-defective cell in the battery pack should be balanced to the same relative capacity as the other non-defective cells. Other than using cell balancing, you can keep the pack cool since heat is one of the primary factors that lead to thermal runaway. This minimizes the retention of heat in the pack. You should maintain the battery environment at room temperature.

Training recognizing issues

Cell Degradation

When a lithium cell is overcharged even slightly above its recommended value the energy capacity, efficiency, and life cycle of the cell reduces. Cell degradation is mainly caused by:

1. Mechanical degradation of electrodes or loss of stack pressure in pouch-type cells. [Source]

2. Growth of solid electrolyte interface (SEI) on the anode. SEI is seen as a cause for capacity loss in

   most, if not all, graphite-based Li-ion when keeping the charge voltage below 3.92v/cell. [Source]

3. Formation of electrolyte oxidation (EO) at the cathode that may lead to sudden capacity loss.

4. Lithium-plating on the surface of the anode generated by high charging rates.

Cell degradation is a serious economic problem that varies according to how the battery is being used.

Training Incomplete Charging

Incomplete Charging of a Cell Pack

Batteries are charged at a constant current of between 0.5 and 1.0 rate. The battery voltage rises as the charging progresses to peak when fully charged then subsequently falls. Consider three cells with 77 Ah, 77 Ah, and 76 Ah respectively and 100 percent SoC and all cells are then discharged and their SoC goes down. You can figure out quickly that cell 3 becomes first to run out of energy since it has the lowest capacity.

When power is put on the cell packs and the same current is flowing through the cells, once again, cell 3 lags behind during charging and may be considered fully charged as the other two cells are fully charged. This means that cells 3 have a low Coulometric Efficiency (CE) due to the cell's self-heating that results in cell imbalance.

Training Incomplete use

Incomplete Use of Cell Pack Energy

Drawing more current than the battery was designed for or short-circuiting the battery is most likely to cause premature failure of the battery. When discharging the battery pack, the weaker cells discharge faster than the healthy cells whereas they reach the lowest voltage more quickly than other cells. Providing regular rest periods during operation of the battery allows the chemical transformations in the battery to keep track of the demand for current.

Training Resources

- ACDC Boston Area
  - Several intensive courses
- Central Piedmont Community College
  - Tailored to specification
  - Emergency Management Training
- National Renewable Energy Labs
  - For Fleets Online courses Administrative
- NC Clean Tech Center
  - Tailored for Fleets Administrative