

What's Inside a Lectric XP eBike Battery?

Version 1.1

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The capacity of my Lectric XP 1.0 eBike suddenly went from 10.4 ampere-hours down to around 5. Such a sudden drop hints at a bad cell. Since this battery is beyond the

warranty period and a new one is coming, I decided to find the bad cell, replace it, and have a backup battery.

It didn't go to plan. Rather than the title saying "How to Repair..." I can only offer you a guided tour of what's inside.

A few high points about my battery:

1. The battery is solidly put together (and a bear to take apart.)
2. The cells are Samsung 18650 29J cells. They are *not* cheap factory rejects.
3. All cells measured 4.1 volts, which is typical of a good cell. I am left with the Battery Management System as a possible culprit.

I will not take apart another one of these batteries with the hope of repairing it. If under warranty, Lectric has been honorable. If not under warranty, I might scavage it for good cells.

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My Journey



There are three easily accessible screws on each end of the battery. Oh boy, this is going to be easy.



Well, not so fast. It felt like there must be a hidden screw since the back cover was solidly attached. I peeled off the foil serial number label and found no screw. Damn!

Then, I carefully pried the top out and slid a screwdriver between the cover and the first set of cells. With a lot of force, I managed to get the cover off.

That is when I discovered the manufacturer squirted an elastomer into the end before screwing on the rear cover.

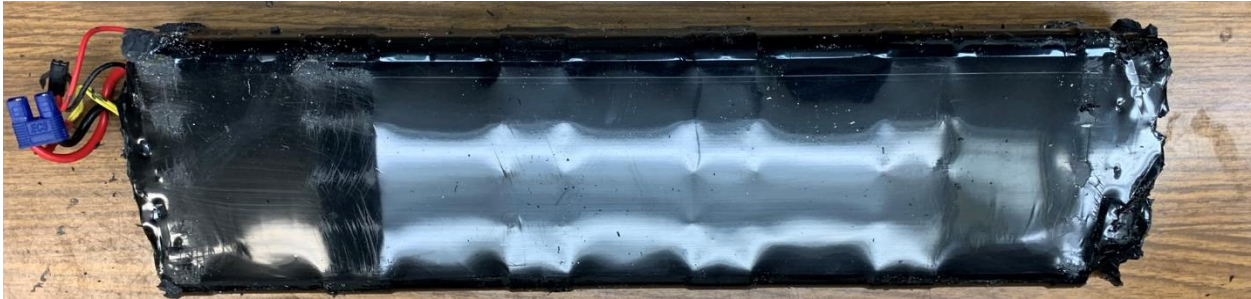


The front end wasn't as bad, but there was a lot of elastomer around the cells.



Going against my better judgment, I slid a hacksaw blade between the cells and the inside of the case. I do not recommend doing such a boneheaded action!

I then pushed the package of cells out the front of the enclosure.



The output terminals and switch were connectorized, so I removed them. The cells and Battery Management System were wrapped in a heavy black plastic film.



Peeling off this film, I found rigid plastic sheets further protecting the cells. At this point, I discovered that Lectric had used Samsung 18650 29J cells.



A total of 52 cells are present. The battery is nominally 48 volts, so it takes 13 cells in series ($13 \times 3.7V = 48.1V$). Dividing 52 by 13 says we have four strings. The peak total output current is 20 amps, meaning

each string must put out 5 amperes peak.

Four cells are wired in parallel to form what I call a group. Thirteen groups are wired in series to produce 48 volts. Given identical cells, when the battery sources 20 amperes, each cell will source 5.0 amperes.

I could only find the 26J cells which are rated at a peak current of 5.2 amperes. They go for \$5 each. I could not find the 29J.

If I were to build this battery, the cells alone would cost ($52 \times \$5 =$) \$260. Lectric sells the completed battery pack for \$299. People that claim these Lectric batteries are cheaply made and overpriced are misinformed.



The manufacturer used a generous amount of Kapton tape over all wires plus black tape over all terminals for added protection.

After peeling off the tape and unsoldering all balance wires, I felt I was near the point of no return. I would need to buy a roll of Kapton tape to replace what I just stripped off.

Using my voltmeter, I measured the voltage between all balancing tabs. They gave me access to all parallel groups of cells. Alas, all read 4.1 volts, which is normal. If I had measured around 3.5 volts, I would have torn down that group to isolate the defective cell.



At this point, my ambitions were reduced to collecting individual LiPo cells. I desolded the groups and performed a final voltage check. All still read 4.1 volts. A load test might expose

one or more weak cells, but I had no desire to reassemble the battery.



I had already removed many delicate insulators that would not stand up to being reglued.

I did try to follow the conductors to see how they interconnected the cells. All I can say is that whoever figured this out must also play a mean game of chess.

I welcome your comments and questions.

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