95 kWh lithium ion battery

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Equipped with a liquid-cooled lithium-ion battery pack with a capacity of 95 kWh, the Model S Plaid offers an impressive estimated range of 359 miles per charge, ensuring long-distance...

Beneath its heavily creased bodywork is a 95.0-kWh lithium-ion battery pack that powers two electric motors, one located at the front axle and the other at the rear.

Automotive lithium-ion (Li-ion) battery demand increased by about 65% to 550 GWh in 2022, from about 330 GWh in 2021, primarily as a result of growth in electric passenger car sales, with new registrations increasing by 55% in 2022 relative to 2021.

The battery powering the 2023 Mini Cooper SE, currently the EV with the smallest battery pack available in the US, has a total or gross capacity of 32.6 kWh, but its usable capacity is 28.9...

Greater capacity, more power, smaller size, lighter in weight, easier to manufacture on a mega scale and with less expensive components are the challenges of designing an EV battery. In other words, it comes down to cost and performance. Think of it as a balancing act where the kilowatt hours (kWh) achieved need to provide the most range, but at a reasonable manufacturing cost. Hence, you often seen a battery pack description listing its manufacture cost coming with numbers such as a range of $240-$280/kWh for example during production.

Oh, and let"s not forget safety. Remember the Samsung Galaxy Note 7 fiasco a few years ago and the EV battery equivalents of vehicle fires and Chernobyl equivalent meltdowns. Spacing between cells in a pack and thermal controls to prevent one cell from igniting another cell, from igniting another cell, etc. in a runaway chain reaction disaster scenario adds to the complexity of battery development for EVs. Of which, even Tesla has had its share of problems.

While EV battery packs consist of three major parts: the battery cells, the battery management system(s), and a box or container of some sort to hold it all together, for now, we will take a look at just the cells and how they evolved with Tesla, but remains an issue for Toyota.

The cylindrical 18650 cell is a lithium-ion type measuring 18mm in diameter and 65mm in length and weighs approximately 47 grams. At a nominal voltage of 3.7volts, each cell can be charged as high as 4.2 volts and discharged as low as 2.5 volts, with each cell storing up to 3500 mAh.

Much like an electrolytic capacitor, Tesla"s EV battery cells consist of long sheets of anodes and cathodes separated by a charge-insulating material and are rolled up and packaged tightly into a cylindrical form to save space and pack as much energy as possible. Those sheets of cathode (negative charge) and anode (positive

charge) each have tabs for connecting like charges between cells resulting in a powerful battery---the sum of many as one, if you will.

There"s a tradeoff, however, primarily of which is more about resistance and heat than it was about the need for a slightly larger can. In the case of the 2170, the increase in the anode/cathode plate sizes resulted in a longer path for charge to travel which meant more resistance and thereby more energy escaping as heat from the cells as well as interfering with rapid charging requirements.

To create a next generation battery cell with even greater power (but without increased resistance) Tesla engineers designed a significantly larger cell with what is called a "tabless" design that shortened the electrical path and thereby resulted in less heat generated from resistance. Much of this can be attributed to who is possibly the best battery researcher in the world.

The 4680 cell is shingle-spiral form design that is simpler to manufacture and comes in a package size of 46 mm in diameter and 80 mm in length. The weight is not available but its other voltage characteristics are reportedly similar or the same; however, each cell is rated for around a whopping 9000 mAh, which is why the new Tesla tabless battery Is so good. Furthermore, its charging speed remained conducive to rapid requirements.

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