White Paper

Subject: Ergotron LiFe Battery Technology

Ergotron introduces a new battery technology into all its StyleView® powered healthcare carts. Ergotron refers to this technology as LiFe, which is a simplified term for Lithium Iron Phosphate (LiFePO4) battery chemistry. LiFe technology has been under development for several years—this paper describes the technology, the reasons why Ergotron has selected it as an alternative to the SLA (Sealed-Lead Acid) batteries for customers, and how it has been made safe.

Advantages

Compared side-to-side, LiFe battery technology's significant advantages over the industry-standard SLA (Sealed-Lead Acid) batteries include:

- **Very Lightweight**: Replacing the SLA-based power system with the new LiFe system in Ergotron's SV42 cart enabled a weight reduction of more than 30 lbs (13.6 kg); the total cart weight is now under 100 lbs (45.4 kg). This provides significant improvement in maneuverability of the cart.
- **Fast Recharge**: LiFe can recharge from a full discharge in 2.0–2.5 hours vs. 6–8 hours for a comparable SLA battery.
- **Long Runtimes**: The 40A-hr LiFe battery can be discharged to zero without degrading the battery life. This provides a practical runtime slightly longer than that of Ergotron's 66A-hr SLA battery because the SLA should not be fully discharged.
- **Longer Battery Cycle Life**: The LiFe battery is expected to last more than 4,000 cycles, which will offer lifetimes of four years and will reduce overall maintenance service actions. An SLA battery typically last only a few hundred cycles with a nine to twelve month life expectancy if properly used.
- **Safety Certifications at Every Level**: The batteries, power module, and complete cart are all certified to government-defined safety standards. In the US, these are UL safety standards defined by OSHA; however, each country has their own additional requirements.

The LiFe battery chemistry also offers significant safety advantages over the Lithium chemistries that are commonly referred to as Lithium Ion or Lithium Polymer. The widely publicized laptop battery fires occurred with Lithium Ion batteries and were attributed to small defects introduced during the manufacturing process. While those manufacturing issues have apparently been resolved, the Lithium Ion chemistry remains susceptible to spontaneous combustion when damaged. Therefore, physical damage to the cells, such as puncturing, can lead to fires. LiFe chemistry has slightly lower energy densities, but can sustain severe physical damage without fire risk.

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Two areas that may be considered disadvantages of LiFe adoption concern higher price points and the perceived uncertainties of new technology. A total cost of ownership analysis, including cost of battery replacement and service fees reveals that SLA technology is still the lowest cost, in both initial investment and return over a five-year period. The cost of ownership difference is less than five percent between these battery types, and Ergotron expects reductions in Lithium battery prices as the technology matures. For many customers, the advantages far outweigh the modest increase in cost.

Battery Technology

Ergotron's choice of battery technology was focused heavily on quality, safety and reliability, and LiFe (Lithium Iron Phosphate) battery chemistry offers that to Ergotron customers. While LiFe has a lower energy density (thus shorter runtimes) than classic Lithium Ion (Li+ or Lithium Cobalt) batteries, it is considerably safer as proven through battery crush and puncture tests. There are numerous studies describing safety of various battery technologies, a good example being a report by Exponent test labs: "BN64159 Comparison of Selected Lithium-Ion Battery Chemistries" (http://www.valence.com). Ergotron explored other Lithium battery varieties such as Lithium Polymer but discovered the batteries did not meet Ergotron's strict safety requirements.

The chemical stability of the Lithium Iron Phosphate chemistry also leads to longer battery cycle life. While there are many battery chemistries listed in technical literature, few have a history of safe and successful manufacturing. The battery technology and supplier Ergotron selected has demonstrated experience in electric vehicles and demanding military applications.

Safe System Design

The battery, power system, and cart form a system which incorporates careful attention to safety at every level. The LiFe battery not only has the safest lithium chemistry, but also has multiple controls in its own electronics to prevent overcharging, cell imbalance, overheating, or other dangerous conditions. There are additional redundant controls in the power module to control the charging process and detect battery temperature. These redundant safety controls are very important with lithium cells. This level of safety protection goes well beyond that which is practical in smaller lithium battery products such as laptops or cell phones.

The cart system is also very important to battery safety. Adequate venting and airflow in the battery compartment, electrical wiring systems and fusing, electrical grounding through the entire cart from monitor to the power cord, power cord and strain relief, are all very critical to the safety of the cart. Ergotron's StyleView carts have now entered the fifth generation with its latest EMR and PHD carts and power system, representing a culmination of the best system designs from the previous four generations of carts.

Safety & Testing

Both Ergotron and its battery manufacturer have subjected the LiFe battery system and LiFe cells to extensive testing. Some of the more aggressive tests include puncturing or shorting the battery to ensure it does not experience “thermal runaway.” Thermal runaway is the condition where a damaged battery melts or catches fire because it is discharging its energy quickly and releases oxygen—which can cause it to self-combust. This is the condition you may have read about occurring in laptop batteries, which are commonly Lithium ion cells. The Ergotron LiFe battery cells have also undergone crush testing, heating tests, and other aggressive exposure and functional tests to ensure it will be safe.

Certifications include:

- The LiFe battery pack is CE marked and certified to UL 2054 and IEC 62133. The batteries have also undergone extensive additional safety testing by Exponent labs.
- The power module has been formally tested and certified to UL 1778 and UL 60601-1 by TUV labs.
- The US power module is certified to UL 1778 and UL 60601-1, and the entire cart with power system is certified to UL-60601-1. Ergotron’s international power module is being certified to IEC 60601-1 with expected completion in Q4 2011. The full cart will then be certified to IEC 60601-1 with expected completion in Q1 2012. These certifications are crucial to ensuring safety of the entire system. This testing also ensures electrical safety, mechanical safety, and electromagnetic interference issues.

Ergotron also tests the entire cart system through additional internal tests developed over five product generations of cart development and use, tests that exceed the requirements defined by UL. Some examples include enhanced cord strain relief testing, 4x load testing and thermal testing of computing devices inside the cart’s enclosure.

Reliability

The long battery cycle life of LiFe battery technology is proven experimentally, and offers clear evidence of improved reliability. The reliability results not only from the LiFePO4 chemistry, but also from the robust control electronics, allowing Ergotron to offer an industry-leading battery capacity warranty. Ergotron warrants the battery will retain at least 70% of the battery capacity for 2 years, plus an additional 3 years of coverage against battery defects.

Conclusion

Ergotron is proud to offer the safest and most extensively tested and proven Lithium battery systems and powered carts in the industry.

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