

Frequently Asked Questions: LIFEPAK® CR Plus Power System

Why does the LIFEPAK CR Plus defibrillator use a “two-battery” system?

For an occasional use defibrillator, this system is the best possible engineering trade-off between battery capacity, ease-of-care, reliability, long life, cost and size. Other battery technologies that could be used for an AED are much larger and costly (Li/SO₂ or Li/MnO₂) or larger, more costly and require more care (rechargeable SLA), or do not work as well at cold temperatures (Li/MnO₂).

The CR Plus power system includes a CHARGE-PAK™ battery charger and an internal Hybrid Layer Capacitor (HLC) battery. The HLC battery is designed to provide the high power that is needed to operate the defibrillator during a cardiac arrest. The CHARGE-PAK Battery Charger is designed to provide the energy to recharge the HLC and keep the AED ready to use while the device is in standby mode. The only care required is to simply replace the small, lightweight CHARGE-PAK as needed. (Patent pending.)


Is the battery fully charged when I receive a new device?

Each LIFEPAK CR Plus defibrillator is shipped fully charged with the CHARGE-PAK and electrodes installed. Also included is a spare pair of electrodes. The CHARGE-PAK and both sets of electrodes carry the same expiration date. It is recommended that when you replace the CHARGE-PAK, you also replace both sets of electrodes so the use by dates continue to match.

Why does the CHARGE-PAK Battery Charger need to be replaced?

The CHARGE-PAK is designed to provide the energy to recharge the HLC battery after a patient use and keep the HLC battery “topped off” and ready to go. In addition, it provides extra energy to allow for the periodic self-tests the device performs, and enough energy to power the readiness display 24 hours a day, month after month. Like a flashlight battery, eventually the CHARGE-PAK needs to be replaced.


When does the CHARGE-PAK need to be replaced?

The CHARGE-PAK is replaced after each patient use, after approximately two years of standby operation (the same schedule as the electrode pads), and after 30 minutes of ON time with no patient connection. Use the LIFEPAK CR-T training system for demonstrations and training. The *CR Plus* carefully monitors all of these conditions and when they occur, the  icon on the readiness display is automatically illuminated to remind you to replace the CHARGE-PAK.

What do I need to do to maintain the battery system?

Almost nothing! The device monitors itself, including the battery system, and indicates its status on the readiness display. Periodically, you should look at the readiness display and confirm that **OK** is displayed, which means the device is ready to use.

What’s the CHARGE-PAK replacement schedule compared to the defibrillation electrodes?

The *CR Plus* has been carefully designed to synchronize the CHARGE-PAK life with the electrode life. This unique design feature makes it very easy to maintain both the battery system and the electrode at the same time. Anytime the  icon on the readiness display illuminates, it is time to replace the CHARGE-PAK and defibrillation electrodes, including any spare electrodes. The CHARGE-PAK and defibrillation electrode(s) included in the replacement kit have been synchronized at the factory. When you install a new CHARGE-PAK, the *CR Plus* reads the replacement date included in the CHARGE-PAK memory and resets the readiness indicator accordingly. Be sure to dispose of all unused electrodes to ensure they are as fresh as the CHARGE-PAK. With this unique system, the *CR Plus* will always be ready to use and you will not need to perform any extra maintenance activity.

Do I need to replace the HLC battery?

No. The manufacturer of the HLC batteries expects them to last more than 10 years when the device is properly used and maintained.

How well does the battery system work at temperature extremes?

The device—including the battery system—is specified to operate between 0°C (32°F) and 50°C (122°F). One of the advantages of the system is virtually no degradation in AED performance over this wide temperature range compared to other battery technologies. The CHARGE-PAK performs best above 15°C (59°F) and works great at warmer temperatures. It will charge the internal HLC battery more slowly at colder temperatures, so charging is not recommended at temperatures below 0°C (32°F).

What happens if the CHARGE-PAK charger is not in the CR Plus when I need it for a cardiac arrest?

Use the device as you have been trained. The power for operating the defibrillator comes from the internal HLC battery, not from the CHARGE-PAK. However, total capacity for the device may be reduced depending on how long the CHARGE-PAK charger has been missing.

If there is no power, continue basic life support until advanced medical help arrives.

What happens if I forget to change the CHARGE-PAK after two years or after a patient use?


The *CR Plus* can still be used for a cardiac arrest if there is adequate power in the internal battery. The defibrillator depends on the CHARGE-PAK to keep the internal HLC battery fully charged. Once the CHARGE-PAK is depleted, the internal HLC battery starts to lose energy. The capacity of the internal HLC depends on a number of conditions, including standby temperature, how much time has passed since the CHARGE-PAK was depleted and how long the *CR Plus* was used.

What happens if I use all the internal battery capacity?

The battery system will typically provide 30 full energy shocks or 210 minutes of ON time. Over 90% of the battery capacity remains after a typical use of the AED for a cardiac arrest case—two shocks with five minutes of ON time (based on post-market data of 209 AEDs used by EMS in 795 incidents).

It's highly unlikely that you would ever completely




deplete the battery, based on studies of defibrillators used by EMS and other medical professionals who respond to cardiac emergencies. Seven hundred ninety-five (795) incidents of the most complex cases (post-market data from five EMS departments) required nine shocks and 26 minutes of monitoring. Even two such cases in a row would leave the internal battery with more than enough power to treat a typical case (two shocks and five minutes of monitoring).

Nonetheless, if the AED is ON and connected to a patient and all the capacity has been used, the device will automatically shut down. Well before shutdown—when at least six full energy discharges or 42 minutes of monitoring capacity remain—a low battery warning  icon shows up on the readiness display.

To prevent accidental battery discharge, the AED automatically turns off after five minutes of inactivity if it is not connected to a patient or transferring data.

How long does it take to recharge the HLC battery after I've used it?

The time it takes to “top-off” the HLC depends on the number of shocks, length of ON time, and the ambient temperature. More than 90% of the AED capacity remains after a typical use of two shocks and five minutes of ON time (based on post-market data of AED use by five EMS departments). After inserting a new CHARGE-PAK into the device and storing it at normal room temperature of 20°C (68°F), it will require 3 1/2 days to essentially “top-off” the HLC battery.

If all or most of the device capacity is used and a new CHARGE-PAK charger is installed, the  icon will remain illuminated for up to two days at temperatures at 15°C (59°F) or above to allow the CHARGE-PAK to partially charge the HLC battery. Once the  icon turns off and the OK icon turns on, the device will have a minimum capacity of six shocks or 42 minutes of ON time. The CHARGE-PAK will continue to charge the internal HLC. Within two weeks of continued recharging at a normal room temperature of 15°C (59°F), the device can provide a minimum of 20 shocks or 140 minutes of ON time. At lower temperatures, charge times will be longer. It is recommended that you store the *CR Plus* defibrillator at a temperature of 15°C (59°F) or higher until the  icon turns off.

How do I dispose of a CHARGE-PAK charger?

Dispose of spent CHARGE-PAK battery chargers in accordance with local, state, and country-specific environmental requirements. Fully discharged CHARGE-PAKs may be disposed of as common trash according to U.S. federal law. However, additional requirements may apply in some states and other nations. Partially discharged CHARGE-PAKs must be disposed of appropriately. Consult the Material Safety Data Sheet for additional hazard information. To arrange recycling services for partially discharged CHARGE-PAKs and for those generated in locations that impose restrictions beyond U.S. federal law, contact ToxCo Inc. (714.879.2067).

How much does it cost to replace the CHARGE-PAK Battery Charger?

The CHARGE-PAK charger is very cost effective. For less than half the cost of traditional defibrillator batteries you get a CHARGE-PAK and a set of electrodes that are synchronized with the expiration date of the CHARGE-PAK.

What tests have been performed to show these batteries are safe?

The Lithium Sulfuryl Chloride and HLC cells are UL-certified as meeting the Standard for Safety, UL-1642, lithium batteries. Environmental testing includes vibration, drop, mechanical shock, combined mechanical shock and vibration, temperature cycling, altitude, impact, humidity and salt spray. Safety testing includes puncture test, crush test, short circuit tests at 25°C and 72°C, heating test at 150°C, leakage test, forced discharge test, charging of discharged cells and charging of multi-capacity cells.

Are there any restrictions on shipping the CHARGE-PAK charger?

Unused CHARGE-PAKs may be shipped without special packaging or labeling. They do not require handling as hazardous goods and there are no restrictions on transport of these batteries by commercial air. Partially discharged CHARGE-PAK chargers, which require shipment to a recycling or disposal location, must be managed appropriately. See the Material Safety Data Sheet for additional hazard information. To arrange recycling services for partially discharged CHARGE-PAK battery chargers, contact ToxCo Inc. (714-879-2067).



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