

# BATTERY USAGE

## FR, FR2, and HS1 Series Defibrillators\*

### Background

The HeartStart (also branded as Heartstream) FR series (ForeRunner, FR), FR2 series (FR2, FR2+), and HS1 series (HeartStart Defibrillator, Home, and OnSite) defibrillators all use long-life Lithium (LiMnO<sub>2</sub>) batteries and have been designed to perform to the following standards (Ref: Instructions for Use/User's Guide):

	Performance for a New Battery			
	Shocks	Standby Life	Operating Life	Training Life
<b>ForeRunner</b> (BT1 battery)	100	1 year minimum	5 hours minimum	10 hours minimum
<b>FR2 series</b> (M3863A battery)	300	5 years typical 4 years minimum	12 hours minimum	N/A
<b>HS1</b> (M5070A battery)	90	4 years typical	3 hours minimum	10 hours minimum

There are other activities that use small amounts of energy in the battery, and if these activities are performed frequently, they can lead to a reduction in the performance life of the FR, FR2 or HS1 series battery. A summary of these activities is outlined below:

### Training

Any use of the FR or HS1 series for training will directly reduce the amount of energy left in the battery to power the unit and will result in a reduction of the battery life. This does not apply to the FR2 series as a rechargeable Training/Administration battery is used while training with the FR2 series. However, the FR and the FR2 series will experience a higher number of Battery Insertion Tests (BITs-see below) with training usage. When training on the FR or FR2 series, the battery must be removed from the defibrillator in order for training to occur (a result of either inserting the training data card, or inserting the Training/Administration battery pack). Upon reinsertion of the battery after training, a BIT will occur with a corresponding energy usage. A BIT is not required in order to move between training and standby modes for the HS1 series.

\* HeartStart/Heartstream ForeRunner, FR, FR2 and FR2+ Defibrillators from Philips, Agilent, Hewlett-Packard, and Laerdal; Philips HeartStart OnSite and HeartStart Home Defibrillators, and Philips and Laerdal HeartStart Defibrillator.

## Battery Insertion Tests (BIT)

Upon installation of the battery into the defibrillator, the unit will perform a BIT which will completely test the unit. A significant amount of energy is used during this test, including capacitor charges and discharges at 150 Joules. As a result, frequent removal and replacement of the battery will result in a noticeable reduction in battery life. Further, turning the unit off during a BIT will cause the unit to perform a monthly self-test in two hours (see below), which also expends battery power.

## Frequent Power-ons

During the first few seconds after turning the defibrillator on, several tests are performed to ensure the AED is ready to perform properly. As a result, frequent power-ons will significantly affect battery life. Turning the unit on periodically in an effort to ensure that the defibrillator is operating properly is unnecessary as the defibrillator will test itself periodically during stand-by mode to help verify the unit is ready for operation at all times. If servicing is required, the FR and FR2 series will notify the user through a flashing or solid 'X' in the status window and a loud chirping sound. The HS1 series will notify the user via a flashing blue 'i' button and a loud chirping sound.

## Monthly Self-Tests

In addition to the daily and weekly self-tests, all models of HeartStart defibrillators perform an extensive self-test once per month. This test uses more energy than other self-tests and includes one capacitor charge and discharge at 150 Joules to test the system. The monthly self-test is also performed in other situations to ensure that the unit is operating properly. For example, if the unit is turned off before the Battery Insertion Test is complete, a monthly self-test will be performed after two hours. A monthly self-test will also be performed two hours after a use (unit turned on with ECG detected, including asystole) has occurred.

## Pads Cartridge Removal/Insertion

Inserting a cartridge into an HS1 series defibrillator will cause the AED to perform a series of tests to help ensure that the pads are ready for use. These tests use small amounts of battery power and frequent cartridge replacement will significantly affect battery life.

## Troubleshooting

Anytime that a battery is suspected of being low or having problems, the first troubleshooting step should be to perform a BIT using the suspect battery, which is initiated by removing then re-inserting the battery into the unit. If the unit passes a BIT with no indications of battery problems, the unit and battery are both ready for service. Other conditions, such as keeping the unit outside the recommended storage temperature can cause failure messages

similar to a low battery message. These messages will be cleared out with a successful BIT. If the unit does not pass the BIT, the BIT should be reattempted with a known good battery in order to determine if the battery is the cause of the failed BIT. If the unit again does not pass, contact Philips Customer Service. In the United States, contact Philips Medical Systems at 1-800-263-3342 for assistance.

## **FR2 Advanced Battery Troubleshooting**

The FR2 series has several advanced features to help the user determine battery health. Each FR2 series standard battery (M3863A) contains electronics that records how much it has been used. This can be checked by inserting the battery into an FR2 series defibrillator and paging through the screens using the upper and lower blue option buttons to get to the Battery History screen (see Section 4 of the Instructions for Use/User's Guide). This will show the USE MINUTES and the CHARGES delivered by the battery. A charge is how many times it has been used to charge the capacitor to 150 Joules, regardless of whether the energy is used for a patient or for internal testing. Monthly self-tests (which may occur more frequently than once a month - see above) use one charge, BITs use two charges, and an actual use can use a number of charges, depending on the nature of the incident.

Another troubleshooting feature of the FR2 series is the Device History screen of the defibrillator. This screen can be accessed similarly to the Battery History screen (see Section 4 of the Instructions for Use/User's Guide). It can be used to obtain the number of USES, SHOCKS, and TESTS that have been performed by the unit. Four figures are shown for TESTS; daily (upper left), weekly (upper right), and monthly (lower left) periodic self-tests, and BITs (lower right). Note that to the FR2 series, shocks and charges are not equivalent. SHOCKS references how many shocks have been delivered by the defibrillator. It is not uncommon for the number of monthly self-tests to be greater than the number of weekly self-tests. This is due to the monthly self-tests occurring during additional situations (see above).