

Technical Note

EFFECTS OF EXTREME ENVIRONMENTS ON HEARTSTART DEFIBRILLATORS

The HeartStart (also branded as Heartstream) FR series (ForeRunner and FR), FR2 series (FR2 and FR2+), FRx series, and HSI series (HeartStart Defibrillator, Home, and OnSite) defibrillators have a recommended environmental range of:

OPERATING TEMPERATURE	32° F TO 122 °F (0° C TO 50° C) - ALL MODELS
Operating Humidity	0% to 95% RH (Relative Humidity) - All models
Standby Temperature	32° F to 109° F (0° C to 43° C) - FR2 series 50° F to 109° F (10° C to 43° C) - FR and HSI series 32° F to 122° F (0° C to 50° C) - FRx series
Standby Humidity	0% to 75% RH - FR and FR2 series 10% to 75% RH - HSI and FRx series

These ranges are specified in the *Instructions for Use (User's Guide/Owner's Manual)* for each defibrillator. The standby temperatures assume that a battery is installed and the unit is stored with defibrillator pads. When the defibrillator and accessories are exposed to environments outside the recommended temperature and humidity ranges, their performance can be affected. Some major effects are outlined below:

PADS

Above Standby Temperature

The gel on the defibrillator pads contains large quantities of water. Over time, this water will evaporate out of the pads through the pads packaging. At standby temperatures, this evaporation will occur over a period of years. Increases in temperature will cause the water to evaporate faster. Storing the pads at temperatures above the suggested storage temperature may cause them to expire prematurely.

Below Standby Temperature

Although the pads contain water, they will not freeze when stored at temperatures below the recommended standby temperature. There are other components in the gel, such as salt, that prevent the water from freezing. Extremely low temperatures may affect pad adhesion and shock impedance. However, when cold pads are placed on a warm patient, they will warm up quickly and will be ready to use for therapy.

BATTERIES

Above Standby Temperature

All batteries self-discharge over time, and the rate of this discharge increases as the storage temperature increases. Storing the batteries (in or out of the defibrillator) above the recommended standby temperature will cause the batteries to become depleted prematurely.

All HeartStart AED batteries contain circuitry that prevents them from operating at elevated temperatures to prevent damaging the defibrillator.

LCD DISPLAYS (FR and FR2 series only)

Above Standby Temperature

A combination of high humidity (above the recommended standby humidity of 75% RH) and high temperature (above the recommended standby temperature of 109°F) for long periods will permanently damage the polarizing layer of an LCD, creating a washed out appearance. A failure of the LCD polarizer does not inhibit or otherwise degrade defibrillator performance.

Note that high temperatures without high humidity can also cause this effect, but the effect is only temporary and the display will recover after returning to specified use temperatures. The combination of both high humidity and high temperature is required to permanently damage the screen.

Below Standby Temperature

Temperatures below the recommended standby temperature of 32° F (0° C) will temporarily cause the LCD display to react slowly and may not produce accurate prompts or ECG readings. This effect is temporary and the display will recover when returned to normal use temperatures.

SELF-TEST FAILURES

The defibrillators will not perform the daily self-tests if the temperature is below 32° F (0° C) or above 122° F (50° C) for the FR, FR2, and FRx series; or below 32° F (0° C) or above 109° F (43° C) for the HSI series. This is to prevent inaccurate results as the electronic components tested perform differently at temperatures outside of the recommended standby temperature ranges. Extended storage above or below these temperatures will cause the unit to begin chirping and produce a flashing red 'X' in the status display (FR or FR2 series) or flashing "i-button" (HSI or FRx series) to warn the user that the tests are not being performed and the unit may not be ready for use. A Battery Insertion Test (initiated by removing and re-inserting the battery) will test the unit and typically clear the failure message.

May 2005