ON-LINE DOCUMENTATION

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8 Safety Considerations

Duracell's nickel-metal hydride batteries are designed to ensure maximum safety. Each cell includes a resealable pressure relief mechanism (safety vent) to prevent excessive build-up of pressure in the cell in the event it is overcharged excessively, exposed to extreme high temperatures, or otherwise abused. Duracell's nickel-metal hydride batteries contain protective devices, as discussed in Section 6.4, to prevent excessive heating during fast charging, high rate discharging beyond design limits, or abusive use.

DURACELL nickel-metal hydride batteries have been tested by the Underwriters Laboratories in accordance with UL Standard 2054 "Outline of Investigation for Household and Commercial Batteries." Duracell successfully met all of the test criteria. The tests required under this Standard and the results of the tests on DURACELL cells and batteries are summarized in **Table 8.0.1**. These tests cover operational and abusive conditions to which batteries may be exposed during their use.

DURACELL nickel-metal hydride cells and batteries that are listed by Underwriters Laboratories under UL Standard 2054 are identified in File No. MH17905. Some DURACELL nickel-metal hydride batteries used in computers are listed under UL Standard 1950 "Safety of Information Technology Equipment, including Electrical Business Equipment," and are identified in File No. E158164.

Safety Considerations (cont.)

Table 8.0.1

Test	Test Conditions	Test Results
Flat Plate Crush Test	Cell is crushed between two flat surfaces.	No explosion, sparks, or flames.
Impact Test	A 20 lb. weight is dropped from height of 2 feet on cell.	No explosion, sparks, or flames.
Short Circuit Test*	Sample is shorted until discharged. Test conducted at 20°C and 60°C (68°F and 140°F).	No evidence of venting, leakage, bulging or other visible changes on individual cells. Maximum case temperature was 129°C (264°F). In batteries, safety devices operated, protecting battery from external short. Maximum battery case temperature was within 5°C (41°F) of ambient.
Forced-Discharge Test (Voltage Reversal)	The cell, after discharge, is over-discharged for 1.5 times rated capacity.	No venting, leakage, fire or explosion on test conducted at C/3 discharge rate.
Abnormal Charge Test	Cell is charged for 2.5 times rated capacity.	No venting, leakage, fire or explosion on test conducted at C/3 charge rate.
Abusive Overcharge Test*	Sample is charged by power supply up to 200 watts until sample vents or explodes.	Individual cells vented. No explosion or fire. Maximum temperature on cell case was 200°C (392°F). In batteries, safety devices caused charging circuit to open periodically, protecting battery as designed. Maximum battery case temperature was within 25°C (77°F) of ambient.
Heat Test	The cell is heated in an oven to 150°C (302°F).	No damage to cells; no bulging, venting, fire or explosion.
Fire Exposure Test*	Sample is heated by a burner fueled with methane.	Cells and batteries vented without exploding. No significant flaming or spark. No projectiles.

Table 8.0.1 Results of DURACELL nickel-metal hydride cells and/or batteries tested under UL Standard 2054 test regimes.

*Note: These tests were conducted on both individual cells and batteries. Tests *not* marked with an asterisk were conducted on individual cells only, as deemed adequate by UL to demonstrate safety of both cells and batteries.