

DATA SHEET OF PURE ENERGY XL RECHARGEABLE ALKALINE CELLS

Cell Size		AA
Open Circuit Voltage		1.57 V
Internal Resistance of Fresh cells		approx. 0.150 Ω
Initial Typical Capacity ¹⁾ , mAh	30 mA to 0.9 V	2000
	125 mA to 0.9 V	1750
	300 mA to 0.8 V	1400
	500 mA to 0.8 V	1200
	1000 mA to 0.8 V	900
Dimensions	Height, in.	1.975
	Height, mm	50.2
	Diameter, inch	0.553
	Diameter, mm	14.0
Average Weight, g		22
Charging (Pulse/Taper) ²⁾	Voltage Limit, V	1.65 ± 0.05 V (for taper charge) 1.75/1.65V (for pulse charge)
	Max. Charge Current, A/cell	1 A
Operating Temperature ³⁾		- 20°C to + 60°C
Storage Temperature	Recommended	+ 15°C to + 35°C
	Tested	Up to 70°C
Shelf life of Fresh Cells		5 to 7 years
Cycle Life ⁴⁾		50 to 500 +
<p>1) Aged cells may require intermittent discharge, which is the typical consumer use, to achieve typical capacity.</p> <p>2) Pulse Charge of XL RAM requires intelligent charger with a special charging algorithm. Contact PEB for details.</p> <p>3) Capacity from cells will be lower at lower temperatures</p> <p>4) Cycle life will strongly depend on factors such as rate of discharge, end point (cut-off) voltage and depth of discharge</p>		

Chemistry

- $MnO_2 + H_2O + e^- \rightleftharpoons MnOOH + OH^-$
- $Zn + 2 OH^- \rightleftharpoons ZnO + H_2O + 2 e^-$
- $Zn + 2 MnO_2 + H_2O \rightleftharpoons ZnO + 2 MnOOH$
- Aqueous potassium hydroxide solution

Additional design considerations:

- Cells also have 'anti-fade' additives to promote rechargeability, catalysts to manage internal gas pressure, a semi-permeable membrane separator to prevent internal shorting and are limited to the 'one-electron' capacity of MnO_2 .

Discharge

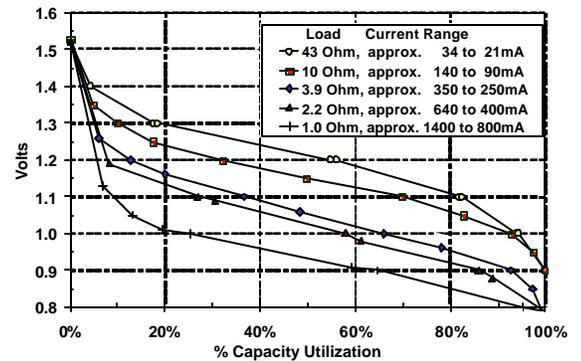


Fig. 2: Normalized Discharge Voltage Curves for AA Cells to Estimate Available Capacity at Various Drain Rates.

Cell Construction

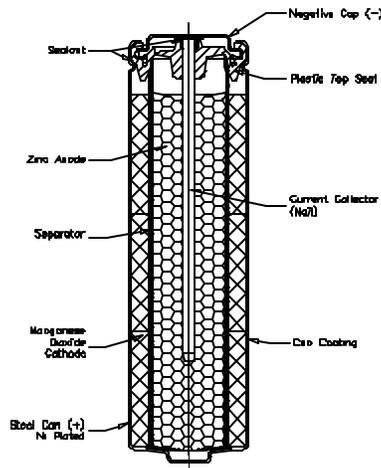


Fig. 1: Cross Sectional View of an AA Cell

Charge

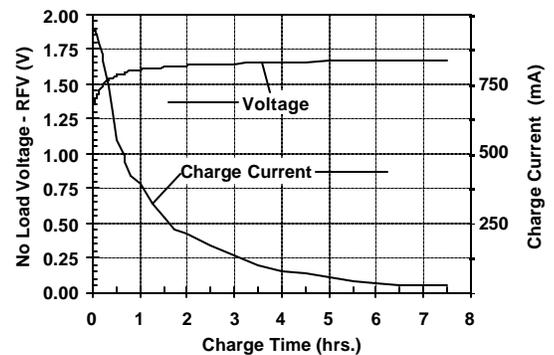


Fig. 3: Typical Charge Curves for Fast Pulse Charge of XL RECHARGEABLE ALKALINE AA Cells.

Deep Discharge Cycling

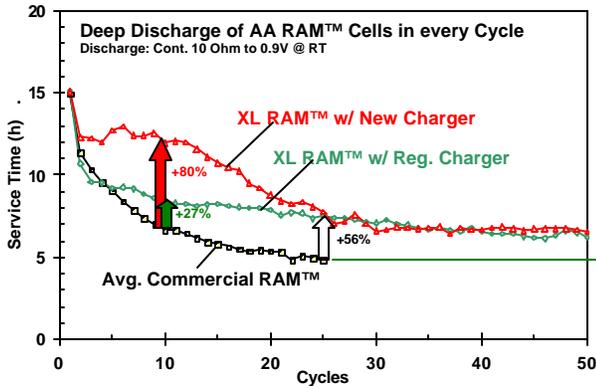


Fig. 4a: Deep Discharge Cycling Comparison of RECHARGEABLE ALKALINE AA Cells on the IEC AudioPlayer Test (10 ohm load, approx. 100-125mA).

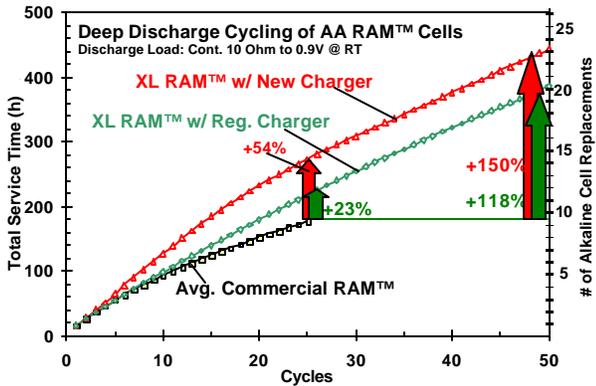


Fig. 4b: Total Service Time on Deep Discharge Cycling of RECHARGEABLE ALKALINE AA Cells on the IEC AudioPlayer Test (10 ohm load, approx. 100-125mA).

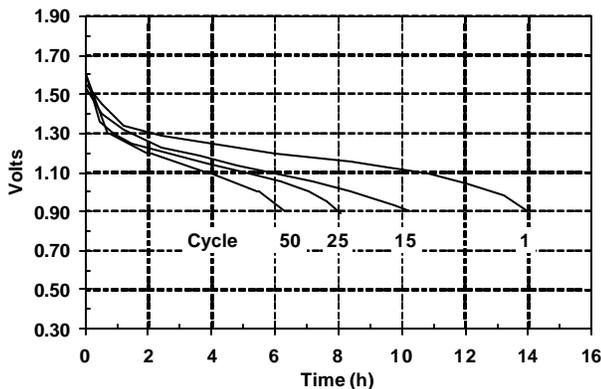


Fig. 4c: Deep Discharge Voltage Cycle Life of XL RECHARGEABLE ALKALINE AA Cells on the IEC AudioPlayer Test (10 ohm load, approx. 100-125mA).

Effect of Depth of Discharge

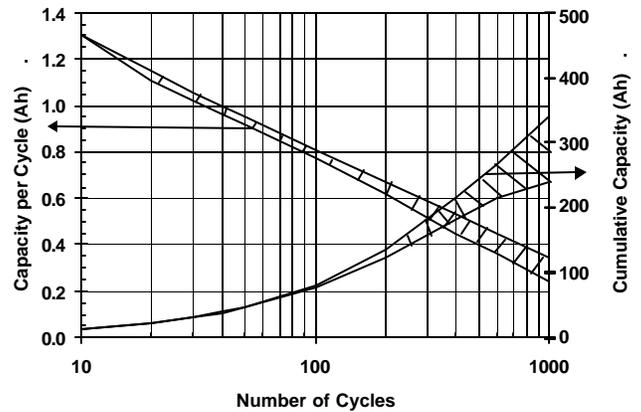


Fig. 5: Performance Range of XL RECHARGEABLE ALKALINE AA Cells as Function of Depth of Discharge on Cycling, Full Recharge after each Shallow Discharge.

Effect of Temperature

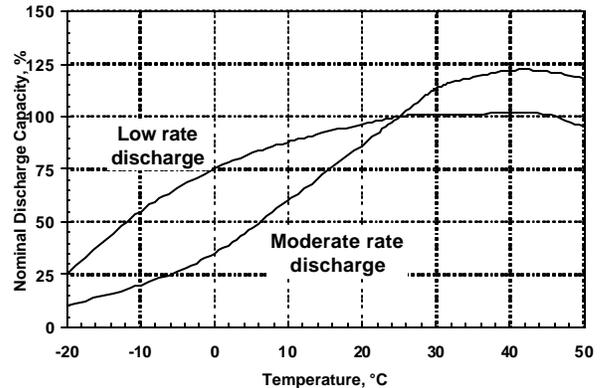


Fig. 6: Effect of Temperature on Capacity of XL RECHARGEABLE ALKALINE Cells.

Self-Discharge Comparison

Capacity Loss	PE-XL	Orig. RAM™	NiCd	NiMH
20°C/month	<1%	1%	20%	25%
45°C/month	3%	5%	60%	80%
65°C/month	10%	20%	100%	100%
Shelf Life	7 yrs.	5 yrs.	charge prior to use	charge prior to use