

## 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 <sup>1)</sup> , 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) <sup>2)</sup>	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 <sup>3)</sup>		- 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 <sup>4)</sup>		50 to 500 +
1) Aged cells may require intermittent discharge, which is the typical consumer use, to achieve typical capacity. 2) Pulse Charge of XL RAM requires intelligent charger with a special charging algorithm. Contact PEB for details. 3) Capacity from cells will be lower at lower temperatures 4) Cycle life will strongly depend on factors such as rate of discharge, end point (cut-off) voltage and depth of discharge		

### Chemistry

- $\text{MnO}_2 + \text{H}_2\text{O} + \text{e}^- \rightleftharpoons \text{MnOOH} + \text{OH}^-$
- $\text{Zn} + 2 \text{OH}^- \rightleftharpoons \text{ZnO} + \text{H}_2\text{O} + 2 \text{e}^-$
- $\text{Zn} + 2 \text{MnO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{ZnO} + 2 \text{MnOOH}$
- 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  $\text{MnO}_2$ .

### Discharge

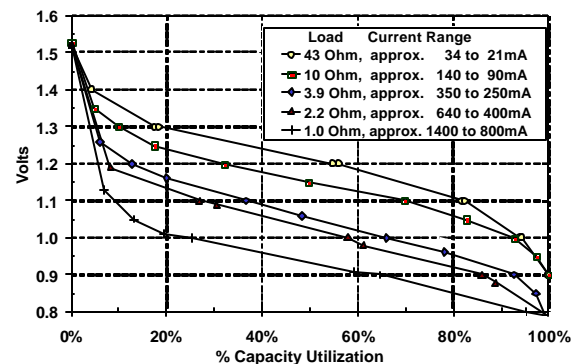


Fig. 2: Normalized Discharge Voltage Curves for AA Cells to Estimate Available Capacity at Various Drain Rates.

### Cell Construction

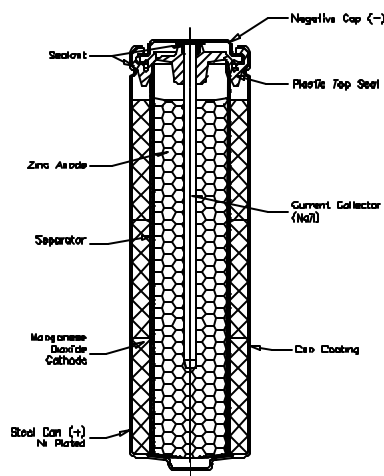


Fig. 1: Cross Sectional View of an AA Cell

### Charge

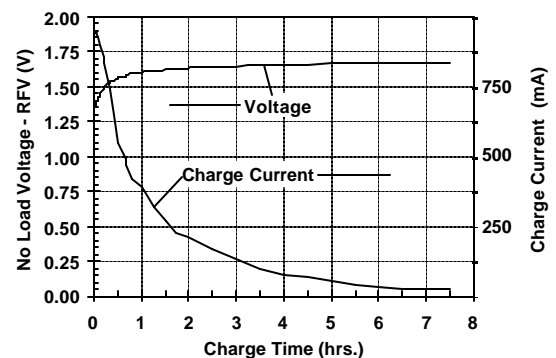


Fig. 3: Typical Charge Curves for Fast Pulse Charge of XL RECHARGEABLE ALKALINE AA Cells.

## Deep Discharge Cycling

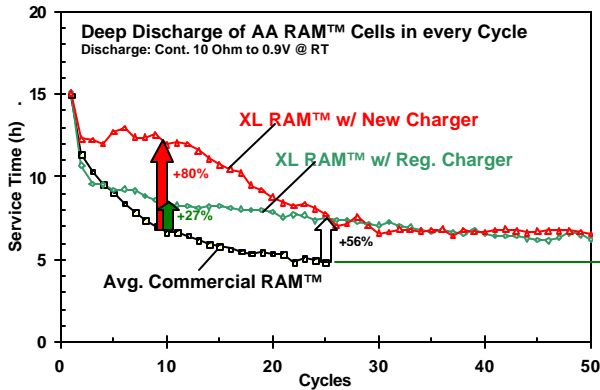


Fig. 4a: Deep Discharge Cycling Comparison of RECHARGEABLE ALKALINE AA Cells on the IEC AudioPlayer Test (10 ohm load, approx. 100-125mA).

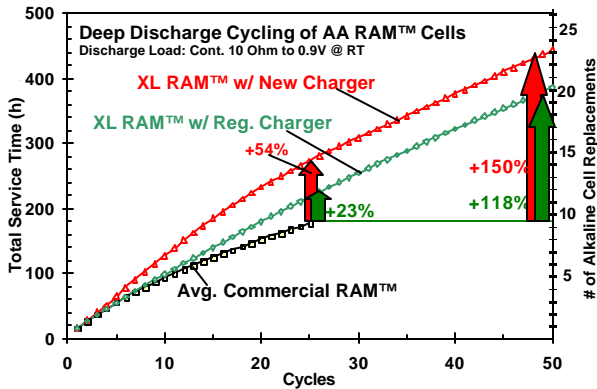


Fig. 4b: Total Service Time on Deep Discharge Cycling of RECHARGEABLE ALKALINE AA Cells on the IEC AudioPlayer Test (10 ohm load, approx. 100-125mA).

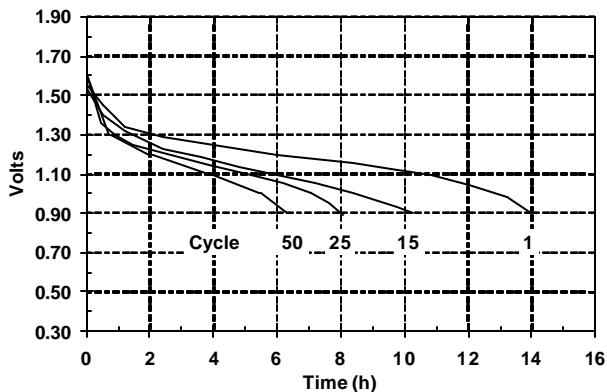


Fig. 4c: Deep Discharge Voltage Cycle Life of XL RECHARGEABLE ALKALINE AA Cells on the IEC AudioPlayer Test (10 ohm load, approx. 100-125mA).

## Effect of Depth of Discharge

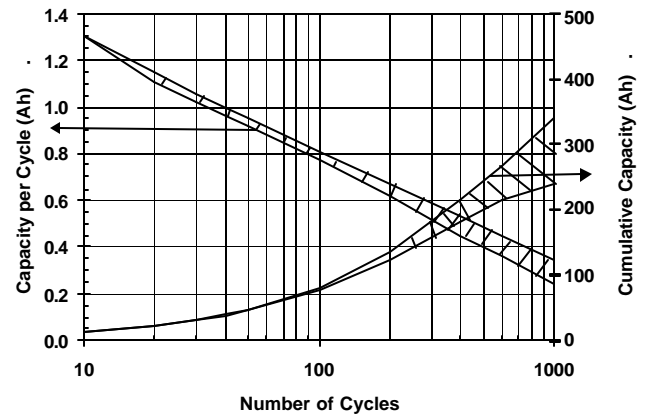


Fig. 5: Performance Range of XL RECHARGEABLE ALKALINE AA Cells as Function of Depth of Discharge on Cycling, Full Recharge after each Shallow Discharge.

## Effect of Temperature

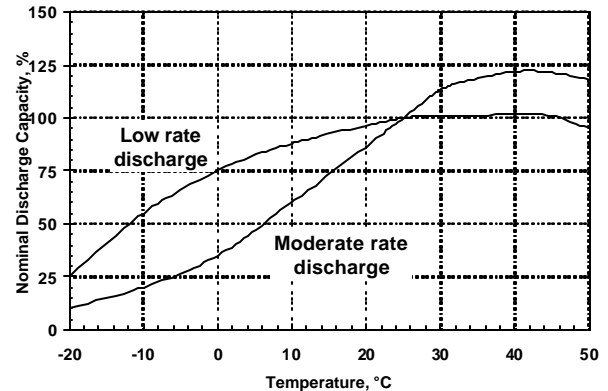


Fig. 6: Effect of Temperature on Capacity of XL RECHARGEABLE ALKALINE Cells.

## 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