

**Specification for**  
**VRE 1/2AA**

<b>Product Manager</b>	<b>Engineering Manager</b>	<b>Project Manager</b>	<b>Quality Manager</b>
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<b>VRE 1/2AA</b>	<b>Issue : O</b>			
	<b>June 2001</b>			

## 1. Scope

This specification applies to a Nickel-Cadmium cylindrical rechargeable single cell which SAFT designation is VRE ½ AA. This cell has been designed for cycling applications requiring a higher capacity in the fields of permanent to fast charge.

## 2. Reference documents

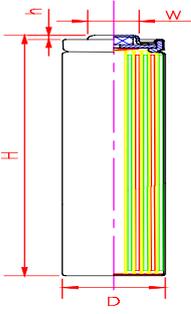
IEC 285/1993 Sealed Ni-Cd rechargeable single cells (+ Amendment 1/1995).

## 3. General electrical specification

Item	Specification	Units	Notes
SAFT cell designation	VRE 1/2AA		
IEC cell designation	KRH 15/30		
Nominal voltage	1.2	Volt	
Minimum capacity	300		
Typical capacity	330	mAh	at 0.2C
Typical impedance	>35	mOhms	at 1000 Hz
<b>Charge current</b>			
Standard	30	mA	with end of charge detection - See 6.1
Quick	100	mA	
Fast	300	mA	
Trickle	25	mA	
<b>Charge duration</b>			
Fast	About 1	hours	Refer to 6.1
Quick	3 to 4	hours	
Standard	16	hours	
<b>Maximum continuous discharge current</b>			
	0.9	A	at 20°C ± 5°C
<b>Temperature range</b>			
In fast charge	+10/+45°C	°C	
In quick charge	+5/+50°C	°C	
In standard charge	0/+50°C	°C	
In discharge	-20/+60°C	°C	
In recommended storage	+5/+25°C	°C	
In extended storage	-40/+60°C	°C	short duration < 1 month

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#### 4. General mechanical specification

With tube Cell drawing	Tube Cell Dimensions
	Diameter (mm) $D = 14.5 + 0 / - 0.50$
	Height: 29.9 mm max
	Positive contact Overstep: 0.8mm
	Typical weight: 12g

#### 5. Capacity

##### 5.1 IEC Capacity

IEC capacity is defined as follows :

- ➔ Temperature :  $+20^{\circ} \pm 5^{\circ}\text{C}$
- ➔ Charge current :  $0.1C = 30 \text{ mA}$
- ➔ Charge duration : 16 hours
- ➔ Period of rest : 1 hour to 4 hour
- ➔ Discharge current :  $0.2C = 60\text{mA}$

The operating time until the voltage drops to 1.0 volt/cell must not be less than 300 minutes - 5 cycles are permitted.

The IEC capacity is then minimum 300 mAh.

##### 5.2 Available capacity

The following cross table gives **Minimum Available Capacities** of a multi-VRE 1/2 AA battery under various discharge currents. The temperature is  $+20^{\circ} \pm 5^{\circ}\text{C}$ , the battery being initially fully charged. Deviation depending on test conditions may be observed.

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<b>CHARGE</b>			<b>FAST</b>	
Rate			1.0C	
Current (mA) <b>(mA)</b>			300	
Duration (hour) <b>(hour)</b>			About 1 hour	
Rest after charge <b>(hour)</b>			No rest	
<b>DISCHARGE</b>		<b>End of discharge</b>	<b>CAPACITY (Ah)</b>	
<b>Rate</b>	<b>Current (mA)</b>	<b>Voltage</b>	<b>mAh</b>	<b>%</b>
C/5	60	1V/ cell	300	100
C	300	1 V / cell	280	93

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## 6. Charge

### 6.1 *Fast charge*

The multi-VRE ½ AA battery can be fast charged within about 1 hour with a suitable end of charge detection and cut-off. Two systems are listed below. The temperature range is +10°/+45°C. The recommended maximum charge current is 300 mA.

#### 6.1.1 *Negative Delta V Detection*

The fast charge is stopped when voltage drops down at 10/15 mV per cell. This cut-off system must be inhibited during the starting 2 or 3 minutes of the charge to avoid early detection. A trickle charge may complete the fast charge to balance the battery and to maintain a full availability of its capacity.

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## 6.2 Other charge rates

Within the following charge rates the charge does not need to be controlled. A TIMER is recommended in the case of a QUICK charge. The TRICKLE charge terminates a QUICK or a FAST charge.

Charge	Rate	Current (mA)	Duration (Hours)	Temperature (°C)
Standard	C/10	30	16	0° / +50°C
Quick (*)	C/3	100	about 4	+5° / +50°C
Trickle	C/35	8.5	Permanent	-20° / +50°C

(\*) If temperature is below 0°C, charge voltage must be limited to 1.55 V/Cell.

## 7. Charge retention

### 8.

After a 28-day storage at  $+20^{\circ} \pm 5^{\circ}\text{C}$  the multi-VRE ½ AA battery shall retain typically 80% of its initial capacity, the battery being initially fully charged. Deviation can be observed.

After 7-day storage at  $+40^{\circ} \pm 5^{\circ}\text{C}$  the multi-VRE ½ AA battery shall retain typically 75% of its initial capacity, the battery being initially fully charged.

## 9. Storage

SAFT recommends to store the battery within the temperature range of  $+5^{\circ}$  to  $+25^{\circ}\text{C}$  in a  $65\% \pm 5\%$  Relative Humidity room on open circuit. After one year storage up to 3 IEC cycles could be necessary to allow the battery to recover its performance. An extended storage within  $-40^{\circ}$  to  $+60^{\circ}\text{C}$  temperature range and  $65\% \pm 20\%$  relative humidity room is permitted for less than one month.

## 10. Overcharge

After a 10-day continuous charge at  $0.1\text{C A} = 70\text{ mA}$  a multi-VRE ½ AA battery will keep its performances without leakage. The IEC capacity will be more than 700 mAh.

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### 11. Cycle life

The cycle life of a rechargeable battery depends on various parameters such as charge rate, discharge rate, depth of discharge, overcharge, temperature, period of rest between charge and discharge and so on.

In fast charge, cycle life depends also on the cut-off method (Negative Delta V, DT / Dt) in addition to the battery configuration.

Typical values for a multi-VRE ½ AA battery are following :

Temperature : +20±5°C Capacity measured at 1,0 volt/cell	Expected Cycle Life (Number of cycles)
End of life when capacity is 70% of initial capacity - Charge C - Discharge C (measured at the 10th cycle) - Cut-off -DV	> 500
Quick charge at 0.33C - Discharge C	> 500

### 12. Operating life in permanent charge

Life duration of a multi-VRE ½ AA battery depends mainly on cells / battery temperature and overcharged capacity.

The end of life of the battery is considered when its capacity reaches 60% of the initial capacity. Typical life of a multi-VRE ½ AA is 3 years with the average operating conditions :

- ➔ permanent temperature                    +20°C ± 5°C
- ➔ permanent charge current                0.05C
- ➔ 1 or 2 discharges per month

### 13 Intermittent charge

SAFT does not recommend the pulse charge because it has a bad effect on the duration life of the battery.

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