Specification for

VH AAH 1500

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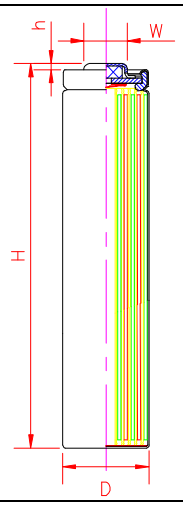
1. Scope

This specification applies to a Nickel-Metal Hydride cylindrical rechargeable single cell which SAFT designation is VH AAH. This cell has been designed for telecom and cycling applications requiring a high capacity.

2. General electrical specification

Item	Specification	Units	Notes
SAFT cell designation	VH AAH		
IEC cell designation	HR 15/51		
Nominal voltage	1.2	Volt	
Typical capacity IEC	1500	mAh	at 0.2C see § 4.1
Minimum capacity IEC	1400	mAh	at 0.2C see § 4.1
Typical capacity in pulse discharge	1310	mAh	See § 4.2
Cycle life	500	Cycles	See § 7
Typical impedance	20	mOhms	at 1000 Hz
Charge current			
Slow	140	mA	0.1C
Fast	1400	mA	with end of charge detection See § 5.1
Charge duration			
Slow	16	hours	
Fast	About 1	hour	
Maximum continous discharge current	4200	mA	3C
Temperature range			
In fast charge	+0/+40	°C	
In slow charge	+0/+40	°C	
in discharge	-20/+60	°C	
Recommended storage	+5/+25	°C	For period shorter than 1 month acceptable temp range: -20/+40°C

3. General mechanical specification

Bare Cell drawing	Bare Cell Dimensions
	Diameter (mm) D= 13.9 ± 0.1 Height (mm) H = 49.9 ± 0.3
	Positive Contact Diameter (mm) W = 4 Overstep (mm) h = 1.7 ± 0.2
	Typical Weight (g) : 26.0

4. Capacity

4.1 IEC capacity

IEC capacity is defined as follows :

- ➔ Temperature : +20° ± 2°C
- ➔ Charge current : 140 mA constant current (C/10)
- ➔ End of charge : 16 hours
- ➔ Period of rest : 1 hour
- ➔ Discharge current : 280 mA constant current (C/5)
- ➔ End of discharge : 1.0 Volt

The operating time (fresh cell) must not be less than 300 minutes (5 cycles permitted).

Typical capacity = 1500 mAh.
Minimum capacity = 1400 mAh.

4.2 Capacity in pulsed discharge

Capacity in pulsed discharge is defined as follows :

- ➔ Temperature : +20° ± 2°C
- ➔ Charge current : 1400 mA constant current (1C)
- ➔ End of charge : -dV (5 mV per cell)
- ➔ Period of rest : No rest
- ➔ Discharge current : 2 A during 0.6 ms, 0.2 A during 4.4 ms
- ➔ End of discharge : 1.0 Volt

The operating time (fresh cell) must not be less than 2,96 hours (5 cycles permitted).

Typical capacity = 1310 mAh.

Minimum capacity = 1230 mAh.

4.3 Capacity at various discharge rate and various temperature

After a charge at 1400 mA (1C) during 72 minutes at 20° +/- 2°C and a rest at discharge temperature during 4 hours, a multi-VH AAH fresh battery will give the following typical capacity (end of discharge at 1.0 Volt / cell):

Unit mAh	-20°C	-10°C	+0°C	+20°C	+40°C	+55°C
C/5 (280 mA)	1250	1380	1400	1460	1350	1290
Pulsed discharge(*)	1080	1180	1310	1420	1330	1290
1C (1400 mA)	400	970	1270	1400	1330	1270

(*) pulsed discharge : 2 A during 0.6 ms, 0.2 A during 4.4 ms.

5. Charge

5.1 Fast charge

The multi-VH AAH 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 0°/+40°C. The recommended maximum charge current is 1400 mA. A 55°C - thermal protection of the Ni-MH pack is needed.

5.1.1 Negative Delta V Detection

The fast charge is stopped when voltage drops of 5/10 mV per cell. This cut-off system must be inhibited during the starting 2 minutes of the charge to avoid early detection.

5.1.2 Derivative Temperature versus time

The fast charge is stopped when battery temperature ratio ($\Delta\theta$ / Δt) reaches a minimum gradient from 0.5° to 1°C per minute. This charging method depends on the battery configuration : assembly, number of cells, localisation of the sensor, nature of the plastic case, ambient temperature and so on.

A top of charge is recommended to complete a fast charge. After end of charge detection and cut-off we recommend to continue the charge with a low current 35 mA (C/40) during 8 hours.

5.2 Other charge rates

Within the following charge rates the charge does not need to be controlled. Nevertheless a TIMER is recommended to limit the charge time.

Charge	Rate	Current (mA)	Duration (Hours)	Temperature (°C)
Slow	C/10	140	16	0°C / +40°C
Quick	C/3	465	About 4	0°C/ +40°C

A trickle charge can be used to maintain the optimum capacity in the battery. The recommended value for trickle charge within the temperature range –5° to +40°C, is 35 mA (C/40). Nevertheless a permanent trickle charge could affect the life time of the battery (especially for higher rate and high temperature).

6. Charge retention

After a 28-day storage at +20° ± 2°C the VH AAH shall retain a minimum of 75% of its initial capacity.

After 7-day storage at +40° ± 2°C the VH AAH shall retain a minimum of 70% of its initial capacity.

In both cases the VHAAH shall recover 100% of its initial capacity after a complete cycle.

7. 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.

The rechargeable battery reaches its end of life when its capacity is 70% of the average capacity obtained in the first 5 cycles. At the end of life of the battery the typical impedance of each cell is 60 mOhm.

Typical values for a multi-VH AAH battery are listed below :

Temperature : +20°C Capacity measured at 1,0 volt/cell	**Cycle Life (Number of cycles)**
Fast charge (see § 5.1) / Discharge at 1C	500
Fast charge (see § 5.1) / Pulsed discharge (*)	500

(*) pulsed discharge : 2 A during 0.6 ms, 0.2 A during 4.4 ms.

8. Storage

SAFT recommends to store the battery within the temperature range +5° to +25°C in a 65±5% Relative Humidity room. After 1 month storage, the VHAAH shall recover 100% of its minimum capacity (after a complete cycle). After a long period of storage in order to reach the optimal performance it is recommended to cycle the cell / battery at least 5 cycles. The VHAAH shall recover 90% of its minimum capacity after 12 months.

An extended storage within -20°/+40°C temperature range and 65±20% Relative Humidity is permitted not more than one month. After 1 month at +40°C, the VHAAH cell shall recover 95% of its minimum capacity (after a complete cycle).

9. Battery assembly

In case of battery assembly please note following rules and recommendations before production proceedings :

9.1 Rules

- ➔ Use components adapted to high temperature : cell sleeve, battery case, insulations, glue, etc.
- ➔ Mount thermal breaker or/and a fuse type polyswitch included in the battery.
- ➔ Adopt appropriate charging system for Ni-MH batteries.

9.2 Recommendations

- ➔ Limit the battery temperature when starting the charge to +40°C.
- ➔ Use -Delta V cut-off at 5-10 mV/cell and or DT/Dt +1°C/minute.
- ➔ Consult SAFT's charging recommendations before designing your applications.
- ➔ Educate your personal about handling and production procedure when mounting Ni-MH batteries.