SPECIFICATION FOR VH Cs 3200 XL

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1/ SCOPE

This specification applies to a Nickel-Metal Hydride cylindrical rechargeable single cell which SAFT designation is VH Cs 3200 XL. This cell has been to provide Power and extended cycle life at high discharge rate, especially for Professional Power OEM application, such as Cordless tooling and Mobility.

2/ GENERAL ELECTRICAL CHARACTERISTICS

All the figures listed in the following tables are based on fresh single cells within one month after delivery. Tests are carried out in accordance with International Standard document IEC 61951-2 .

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ITEM	SPECIFICATION	UNITS	NOTES
MAIN CHARACTERISTICS			
SAFT cell designation	VH Cs 3200 XL		
IEC cell designation	HRX 23/43		
Nominal voltage	1.2	Volt	
Rated IEC capacity	3000	mAh	As per IEC 61951-2
Typical capacity*	3200	mAh	*After charge 16h at C/10 and discharge at C/5
Typical impedance	<4	mOhm	At 1000 Hz
CHARGE CURRENT			
Standard	300	mA	
Fast*	Up to 3000	mA	* Charge termination recommended. (5.2)
Topping**	200-300	mA	** After a main charge (5.2)
Trickle***	80-100	mA	*** After a topping charge
Pulsed	-		Consult SAFT for details
CHARGE DURATION			
Standard	16	hours	
Fast	1-2	hours	
DISCHARGE CURRENT			T°C/20°C +/-5°C
Maximum continuous current	40	A	max end of discharge voltage 0.8V/cell
Max peak (<1s)	150	A	max end of discharge voltage 0.6V/cell
TEMPERATURE RANGE			Temperature of start up
In slow/standard charge	0/40	°C	
In fast charge	0/35	°C	
In discharge	-10/40	°C	Until 12A discharge at –10°C
In storage			See § 7
Recommended	5/25	°C	
Low limit range High limit range	-40 to +5 25 to + 60	°C	Shorter than 1 month
TYPICAL WEIGHT	58	g	

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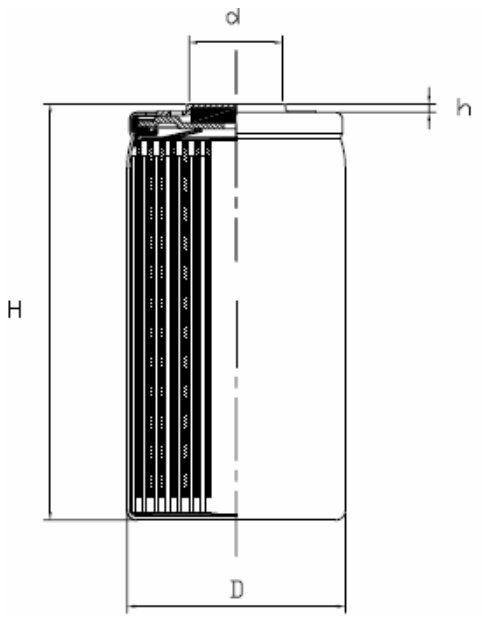
3/ GENERAL MECHANICAL CELL SPECIFICATION

BARE CELL DRAWING	BARE CELL DIMENSIONS (mm)
	**Diameter:** D= 22 +/- 0.05 **Height:** H= 42.4 +/- 0.2 **Positive contact** **Flat area diameter:** d= 10.0+/- 0.1 **Overstep:** h= 0.85 +/- 0.2

4/ CAPACITY

IEC Capacity is defined as required in IEC 61951-2

- Temperature : +20°+/- 2℃
- Charge current : 300 mA constant current (C/10)
- Charge duration : 16 hours
- Period of rest : 1 hour
- Discharge current : 600 mA constant current (C/5)

Minimum capacity : 3000 mAh

5 cycles are allowed to get the specified value.

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5/ CHARGE RECOMMENDATIONS

Global Charge control methods:

Ni-MH cells are normally assembled in series. Charging of Ni-MH cells shows many analogies and similarities as with that of Ni-Cd cells. The main difference is that the temperature change is exothermic from the beginning of the charge. As temperature increase is detrimental to life duration of the cell (due to MH alloy corrosion), and in order to ensure a good compromise between capacity and life duration, it is highly recommended to charge the VHCs 3200 XL (single cell or pack) by managing the temperature change of the single cell or of the battery pack. DT/dt level should be calibrated at the slope value corresponding to approximately 40°C (in the cell or pack), in order to detect the end of the main charge before the peak voltage. The value of this dT/dt, depends upon the battery pack configuration and charge rate, for single cells, 0.5°C is generally p ermitted.
Use of –dV charge termination is not recommended as main charge method because when the detection of –dV occurs, the temperature is too high to ensure good cycling, especially in battery packs.

SAFT DOES NOT RECOMMEND THE CHARGE OF A CELL OR BATTERY PACK AT CONSTANT CURRENT HIGHER THAN C, BECAUSE THE TEMPERATURE INCREASE IS TOO FAST.

Fast charge:

Fast charge (up to 3000mA) can be stopped before excessive temperature in the cell or battery pack with a good calibration of the dT/dt measurement. Then, the charge can be completed with a topping charge to stop the temperature increasing too rapidly. A topping charge corresponding up to 10% of the rated capacity at a rate from 200 to 300mA, can be applied. A trickle charge can be added at lower current rate (from 80 to 100mA) to be adapted according to the pack configuration. For charge on single cell (up to 3000mA), -dV (0.1 to 0.5%) can be admitted even if dT/dt is more suitable. However, -dV can be admitted as cut-off for quick charge on a single cell, but **never** as the main charge cut-off system for a battery pack, it can only be considered as a back-up system. In addition, a TCO at 50°C and a timer can be used as the second back-up system.

Standard charge:

At very low charge rate (C/10) the charge of single cell can be controlled by a timer, but on a pack, even at this low rate, it is recommended to use dT/dt as charge cut-off. As for other charge rates, -dV can be used as a back-up charge cut-off, with a TCO at 50°C and timer as the second back-up system. Trickle charge can be added at lower current rate (from C/30 to C/100) which has to be adapted according to the battery pack configuration.

6/ CYCLE LIFE

The cycle life of a rechargeable cell depends on various parameters such as charge rate, discharge rate, depth of discharge, overcharge, temperature, period of rest between charge and discharge. Typically a rechargeable cell reaches its end of life when its capacity is 70% of the average capacity obtained in the first 10 cycles.

Typical cycle life values for a single cell VH Cs 3200 XL are listed as:

TEMPERATURE: +20°+/- 5°C CAPACITY MEASURED AT 1,0 VOLT/CELL	EXPECTED CYCLE LIFE (NUMBER OF CYCLES)
Charge C/2 with (dT/dt) cut-off; Discharge 3A	>900
Charge C/2 with (dT/dt) cut-off; Discharge 6A	>900

7/ CELL AND BATTERY MANAGEMENT

- Overcharge :

The VH Cs 3200 XL cell is not designed to be permanently overcharged. Repeated overcharging could cause leakage and results in the deterioration of the cell performance.

- Over discharge :

A deep discharge or “over discharge“ (at a current rate higher than C/10) could damage the cell performance, so it is recommended to manage the discharge with appropriate discharge cut-off (consult Saft) and to avoid to let the cell/ battery connected to the equipment for a long period.

- Storage :

After a 28 days storage at +20° ± 5℃, or 7 days st orage at +40° ± 5C the VH Cs 3200 XL cell, shall retain typically 80% (minimum 65%) of its initial capacity, the cell being initially fully charged. In both cases, the VH Cs 3200 XL cell shall recover full initial capacity after a complete cycle. **In all cases, it is recommended to store the cell or battery in a minimum charged state of (30/35%) and in an open circuit condition.**

- Normal conditions:

SAFT recommends to store the cell or battery within a temperature range of +5° to +25℃ in a 65 ± 5% relative humidity atmosphere and to avoid storing the cell or battery in a discharged state.
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After 4 months storage at room temperature or 1 month at 40℃, the VHCs 3200 XL shall recover 100% of its minimum capacity (after 5 application cycles).

An extended storage between -20℃+5℃ and +5℃/60℃ and 65% relative humidity is permitted for no more than one month.

- Long term storage (up 6 months):

Long term storage leads prolonged battery self discharge and deactivation of chemical components. SAFT recommends storing the cell or battery under Normal conditions listed above.
In such a case, it is recommended to partially recharge the (cells/battery), (30/35 %) every 6 months. In addition, when using the batteries for the first time after 6 months storage and in order to restore the initial cell performance, it is recommended to full cycle the cell/battery (maximum 5 cycles). In these conditions, the VH Cs 3200 XL cell shall recover 95% of its initial capacity, even after 12 months storage.

- Service life :

Normally, if a cell or battery pack is used under normal conditions as described above, a cell should last for 2 years or 900 cycles. Failure in charging, discharging, storage or temperature range can reduce the service life and damage the cell performances.

- Battery assembly :

The cells have an intrinsically safe design. This means that in case of abusive use (such as but not limited to overcharge, overdischarge, external short-circuit), some electrolyte and oxygen/hydrogen gas mixture may be expelled through the safety vent of the cells.
When multiple cells are assembled into a battery pack, it is required to implement the appropriate protection devices necessary to insure the safety of the battery pack in case of abusive use.
Consult SAFT for advice in battery assembly.

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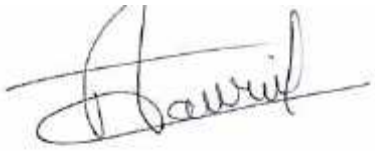
8/ SPECIFICATION APPROVALS

PRODUCT MANAGER:	**F.Auriol**	
TECHNICAL DIRECTOR:	**C.Chanson**	
PROJECT MANAGER:	**JM. Bobe**	
QUALITY DIRECTOR:	**J.Seganti**