

# VRNM Nickel-cadmium battery

Ultimate ultra-low maintenance solution



**Saft India Private Limited**  
(Formerly known as Amco Saft India Pvt. Ltd.)

# Saft India Ni-Cd batteries The broadest capability in the world



**Saft India Ni-Cd batteries are one of the world's most reliable power back-up systems. For improving quality and safety, safeguarding the environment and reducing Total Cost of Ownership (TCO), only Saft India Ni-Cd batteries provide a truly reliable solution.**

**For installations requiring totally reliable power back-up, failsafe engine starting or bulk energy storage, the uniquely long life and low maintenance characteristics of Saft India Ni-Cd batteries cannot be surpassed.**

**More than 100 years' experience in developing pocket plate technology is built into every Saft India Ni-Cd battery.**

## VRNM Ni-Cd battery Performance with ultra-low maintenance

Developed in line with long proven Ni-Cd technology, VRNM is an exceptionally reliable ultra-low maintenance pocket plate battery incorporating special technical features.

Delivering long life and requiring no or minimal maintenance, there is no better solution for installations where the risk of failure is unacceptable, as in:

- UPS systems
- emergency lighting
- process control
- telecommunications
- offshore oil and gas
- gas pipelines
- railway signalling
- emergency lighting
- security systems

The VRNM Ni-Cd battery is eminently suitable for "remote" applications such as offshore and switching substation operations, where the system must be totally reliable and require minimum number of maintenance visits.

VRNM batteries are supplied as single cells of 1.2 V in a capacity range from 9 Ah up to 750 Ah.



## VRNM Ni-Cd battery Main benefits

### Performance in temperature extremes

VRNM operates with total reliability over a wide temperature range: - 20°C to + 40°C and exceptionally from - 50°C to + 70°C.

### Safety without compromise

Ni-Cd pocket plate technology eliminates all risk of sudden death during the battery's exceptionally long service life. VRNM is resistant to electrical and physical abuses. With fast recharging and extended storage, the unit is not only simple to install but is also environmentally safe.

### Reliable by design

The pocket plate construction of electrodes ensures well proven advantages, reliability and long life.

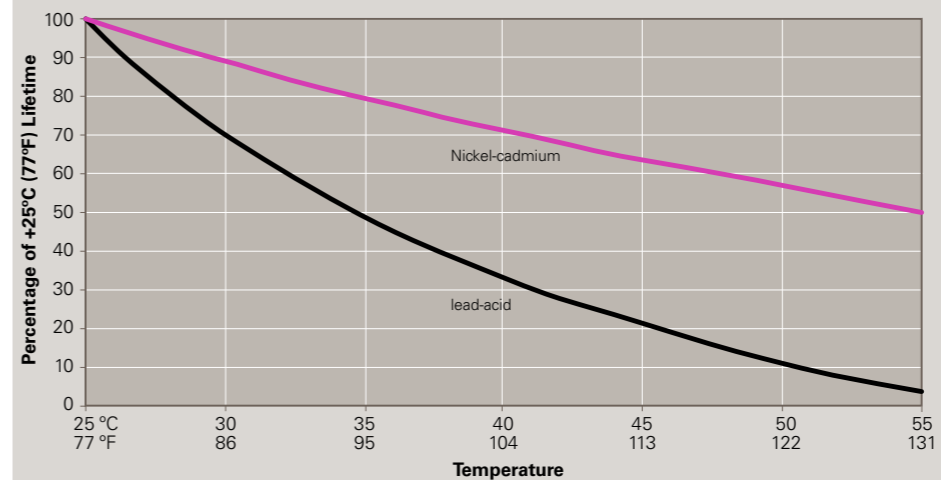
Apart from special fibrous separator and pressure vent many constructional features are incorporated in VRNM that makes it the ultimate maintenance-free battery:

- iron-free negative electrodes for long life in tropical conditions and excellent charge acceptance even at low charging voltage
- excess negative capacity with large negative electrode surface for effective recombination
- additives in negative plates for effective recombination at low pressure

The inherent characteristics of VRNM batteries provide specific operating advantages:

- absolute reliability
- freedom from topping up
- pre-charged, ready for use
- tolerance to extremes of temperatures
- very long life
- excellent discharge performance
- enhanced charge acceptance
- operation in narrow voltage window

### Effect of temperature on lifetime



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## VRNM Ni-Cd battery



### No water filling

No water filling is necessary during the VRNM service life under recommended conditions of use because of the large electrolyte reserve, the controlled recombination and the valve regulated venting system (topping up is possible if required).

### Valve regulated system

Controlled recombination is made possible through a specific cell design and low pressure flame arresting vent. The risk of thermal runaway is eliminated by the use of free electrolyte – a major advantage over VRLA batteries where starved electrolyte is often the cause of failure.

### Designed to be durable

VRNM's tough cell containers, battery's positive nickel hydroxide and negative cadmium hydroxide plates, and alkaline electrolyte deliver optimum performance without compromising structural integrity.

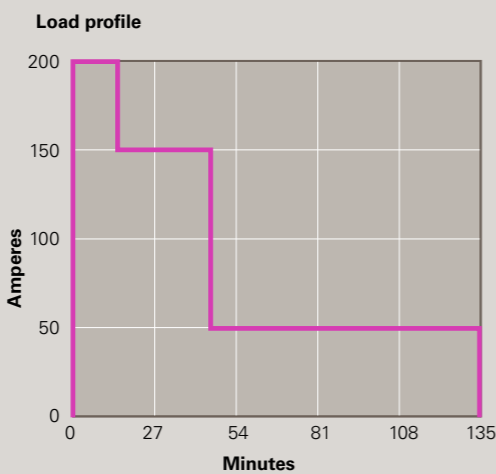
### Quality built, quality tested

VRNM is manufactured in India; one of Saft India's many internationally accredited ISO 9001 sites.

### Calculating your battery size

It is important to specify the optimum battery size for your particular installation. Nickel-cadmium ranges offer many capacity steps to create the optimum battery for your application. Saft India's battery sizing software has been developed to make your battery selection easy. Our sales engineers have been specifically trained to fine-tune sizing of the batteries according to your specific conditions.

### Stationary Ni-Cd battery sizing



### Battery layout

Connector between blocks



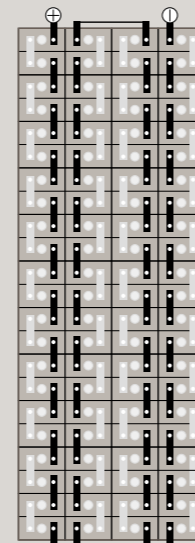
End lug



Cable between steps/rows, inside-inside



Cable between steps/rows, outside-outside



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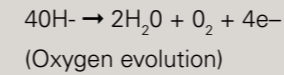
## VRNM Ni-Cd battery

# Construction features

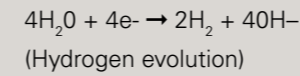
### Recombination Cycle:

In a flooded Ni-Cd battery following reaction occurs on over charge.

#### At the positive plate

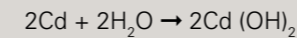


#### At the negative plate



During charging phase, oxygen evolution starts a little before the positive plate is fully charged. Excess negative capacity of VRNM ensures that oxygen evolution commences prior to hydrogen evolution.

Porous separators facilitate diffusion of oxygen that reacts with cadmium at negative plate and chemically discharge cadmium into cadmium hydroxide.



The current passing through the cell keeps recharging the negative electrode. The process of oxygen generation at positive plate and its getting consumed at negative plate is known as oxygen recombination cycle.

### 1. Electrode assembly

The active material is retained in pockets formed from perforated nickel-plated steel strips. This mechanically robust pocket plate construction ensures conductivity and robustness. Large surface area of negative electrode and special additives in negative active material enhance faster oxygen recombination hence high rate of overcharge is possible. The supporting structure of electrodes is made of nickel-plated steel and is inert to alkaline electrolyte. There is no corrosion and no risk of "sudden death."

### 2. Separator

A thick fibrous material ensures separation between electrodes of opposite polarity. Separator also retains the oxygen gas till it gets recombined at negative electrodes. The separator holds generous quantity of electrolyte between plates, eliminating the risk of thermal runaway.

### 3. Electrolyte

The electrolyte used in VRNM cells is aqueous solution of potassium hydroxide and Lithium hydroxide. It is not necessary to change the electrolyte during the life of the cell.

### 4. Terminals

Easy to bolt nickel plated terminals made of steel are provided for both polarities.

### 5. Cell containers

VRNM cell containers and lids are moulded from translucent polypropylene. Containers and lids are thermo-welded to ensure airtightness.

### 6. Venting system

VRNM cells are fitted with low-pressure vents. This vent acts as one-way self-resealing valve to prevent air from entering cell, at the same time vents out gases generated during over charge.



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## VRNM Ni-Cd battery

### Technical Characteristics

#### Nominal voltage: 1.2V/cell rated (nominal) capacity

Rated Capacity  $C_5$  is defined as available ampere-hours (Ah) at 5 hours discharge rate to an end cell voltage 1.0V/cell at ambient temperature + 20°C.

#### Internal resistance

Internal resistance of VRNM at room Temperature when measured after float charging is:  $100 \times 1/C_5$  milliohms.

#### Short circuit current

Maximum short circuit current in amperes is:  $15 \times C_5$  Amps. VRNM batteries can withstand its short circuit current without damage.

#### Charging characteristics

VRNM batteries can be charged by the following methods:

- **Single level float charging:**

VRNM batteries can be charged using constant potential charger at 1.40 to 1.43 V/cell.

80% capacity is recharged in 8 hours and 16 hours respectively at  $0.2C_5$  and  $0.1 C_5$  charging rates.

Full capacity is achieved in 30 hours of recharge.

- **Dual level constant potential charging:**

- First charge with a current limit of  $0.1C_5$  to an average maximum voltage of 1.45 V/cell

- Alternatively, if faster rate of charging is required, a voltage limit of 1.55 V/cell can be used

- After the first stage, switch to float voltage in the range 1.40 to 1.43 V/cell

- After every deep discharge, the first stage should be reapplied manually or automatically



#### Special operating factors

##### Ripple effect

Like other Ni-Cd batteries VRNM can tolerate high ripple from charging system. Ripple up to 15% has no effect on water loss or life of battery.

##### Over-discharge

Unlike lead-acid battery VRNM does not fail when cells are discharged more than their rated capacity. VRNM is designed to make recovery from this situation.

##### Over charge

VRNM with its generous electrolyte reserve is unaffected by small degree of overcharge. In case of excessive overcharge, a situation that will destroy a VRLA battery, VRNM can be refurbished by topping up.

##### Cycling

Cycling capability of VRNM is excellent as other pocket plate Ni-Cd batteries. Since VRNM operates at low charging voltage, charging time between deep cycles should be sufficient to recharge battery.

##### Mechanical abuse

Like other pocket plate type Ni-Cd batteries, VRNM is resistant to high degree of shock and vibration. VRNM cells are assembled in polypropylene, all external metal components are nickel-plated and are protected by neutral grease and plastic cover. The battery can withstand corrosive environment.

##### Installation and maintenance

VRNM batteries are normally supplied filled with electrolyte and charged, ready for immediate use. These can be stored in this condition for up to two years. No commissioning charge required if commissioned within six months from dispatch. VRNM is a maintenance-free product and requires minimum attention. A visual check once in six months for electrolyte level and cleanliness of external components is adequate.

##### Discharge performance

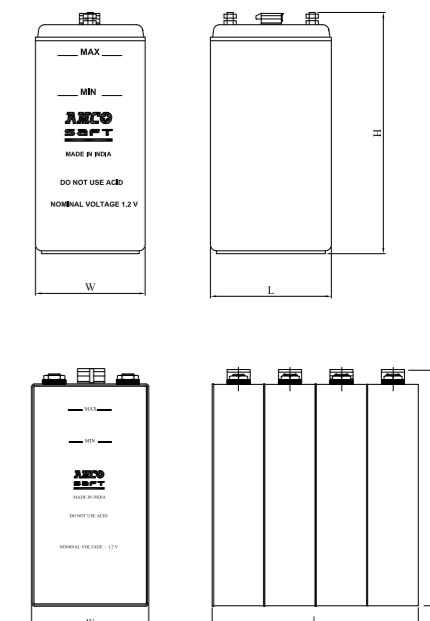
Discharge currents available for different time durations and to different end cell voltages are given in tabular discharge data. Data is based upon cell performance, after several months of floating at 1.42 V: this eliminates correction factors such as "floating" which needs to be used when sizing batteries.

# VRNM

Cell Type	$C_5$ Ah	Cell Dimension			Terminals	Cell Wt (KG)
		L (mm)	W (mm)	H (mm)		
VRNM 9	9	46	87	280	M10	1.6
VRNM14	14					1.8
VRNM19	19					2.8
VRNM26	26					3
VRNM32	32	86	87	280	M10	3.1
VRNM37	37					3.2
VRNM41	41					4.7
VRNM44	44					4.8
VRNM54	54	58	139	390	M10F	5
VRNM58	58					5.2
VRNM67	67					6.1
VRNM73	73					6.3
VRNM81	81	75	139	390	M10F	6.5
VRNM90	90					9
VRNM100	100					9.2
VRNM107	107					9.5
VRNM116	116	103	165	390	M10F	10
VRNM125	125					10.2
VRNM133	133					10.4
VRNM143	143					10.6
VRNM150	150	128	165	390	2XM10F	12.7
VRNM161	161					13
VRNM166	166					13.3
VRNM183	183					13.6
VRNM200	200	156	165	390	2XM10F	15.5
VRNM215	215					15.8
VRNM233	233					16.2
VRNM250	250					16.5
VRNM280	280	176	195	400	2XM10F	20.2
VRNM300	300					20.8
VRNM320	320					28
VRNM355	355					28.7
VRNM385	385	261	195	400	3XM10F	29.5
VRNM415	415					30.3
VRNM450	450					31
VRNM475	475					38
VRNM512	512	345	195	400	4XM10F	39
VRNM555	555					40
VRNM600	600					41
VRNM640	640					50
VRNM695	695	430	195	400	5XM10F	51.2
VRNM750	750					52.5

# Saft India

## VRNM Ni-Cd battery









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