MAINTENANCE-FREE RECHARGEABLE SEALED LEAD-ACID BATTERY

Technical handbook

SLA10/97

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1. Introduction

VABO SLA-BATTERIES are maintenance free sealed lead acid rechargeable batteries. The batteries are having excellent economy stability and superior output. Various characteristics have been improved such as leak proof, overcharging and overdischarging. This compact & powerful sealed lead-acid battery with higher performance can be used as a power source for portable instruments and also for power backup use. VABO SLA-BATTERIES are now being used in a wide range of applications.

VABO SLA-BATTERIES are used for portable VTR, cleaners and electromotive tools which is requiring light weight, compactness and high power and also used for backup of OA-FA, U.P.S. or security systems, telecommunication and emergency facilities requiring long-term reliability. Thus, VABO SLA-BATTERIES are high-performance batteries exerting the higher reliability in a wide variety of applications.

2. Technical features

2.1 Maintenance-free

The gas evolved from the positive plates diffuses through the microporons glass fibres to the negative plates where it is changed to water by the recombination reaction, eliminating the need for adding water.

2.2 Leak proof construction

By the special sealing design, there is no leakage of liquid & gas and it is safe for all applications. It can be installed in equipment safely without any leakage

2.3 Low self-discharge

VABO SLA-BATTERIES keep a low rate of self-discharge by the employment of PB-Ca plate grids, the low selfdischarge rate allows long shelf life under an ambient temperature of 20°C (68°F)

2.4 Design Availability

VABO SLA-BATTERIES can be used in series and or parallel according to the required voltage and capacity.

And also, the same battery may be used in either cyclic or standby applications without loss of life or performance.

2.5 Economical and durability

Corrosion-proof Pb-Ca alloy and improved form of the grid and active material are combined to guarantee a longer life and lower internal resistance, higher battery performance, thus ensuring maximised economy.

2.6 Compactness

VABO SLA-BATTERIES utilise up-to-date design, highest grade materials, and a strictly controlled manufacturing process to provide excellent output per battery.

2.7 Wide operating temperature range

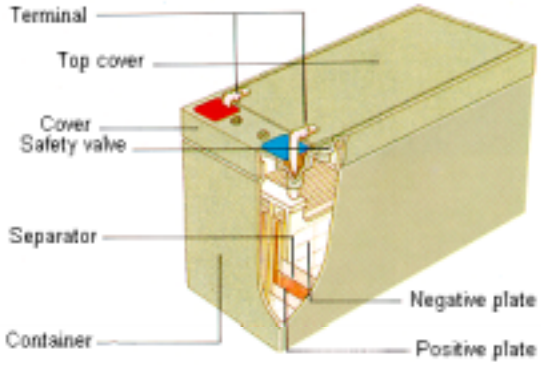
VABO SLA-BATTERIES can be used in temperature range of -20°C (-4°F) to 50°C (122°F)

2.8 High recovery of deep discharge

Highest grade of materials such as special A.G.M. separators, advanced plate composition and a strictly balanced electrolyte system have greatly improved the capability of recovering from deep discharge.

3. Construction of the battery

Each battery is a combination of one or more cells. Each cell consist of a positive plate, negative plate, separator and terminals. And all these components are assembled in a container , the battery case, which consists of a cover with safety valves and a top cover made from ABS resin.



Components	type
Plate	Paste type
Container, Cover, Lid	Synthetic resin ABS
Separator	Absorptive Glass fibre Mat
Terminal	White copper
Electrolyte	Sulphuric Acid
Safety valve	Rubber (with special oil)

3.1 Plates

The positive and negative plates are made of pure lead oxide pasted on a grid of Pb-Ca alloy that can be recharged quickly even when over-discharged.

3.2 Separator

Absorptive glass material (AGM) with high & long durability is used for separators, which absorbs electrolyte and retains the constant volume of the electrolyte.

3.3 Safety valve

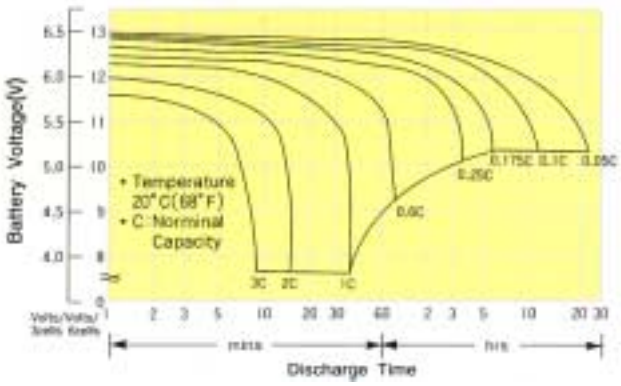
The safety valve is made of rubber with a special oil. It releases excessive gas automatically caused by internal pressure from overcharging. It is designed to return the gas inside the battery.

3.4 Container and cover

The container and cover are made from ABS, a synthetic resin which has an excellent acid resistance and durability. These are designed to be sealed completely to prevent any leakage of electrolyte and gas.

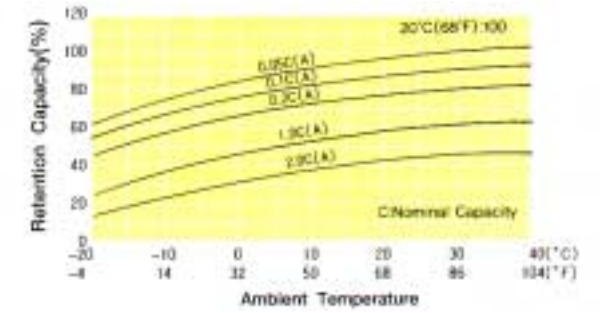
4. Characteristics

4.1 Discharge time vs. discharge current



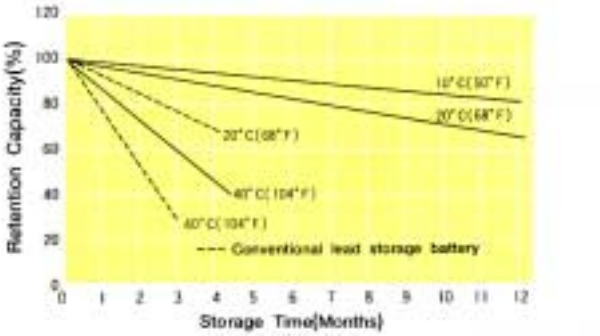
The capacity of a battery (Ah) is represented by the product of the discharge current (A) and the discharge time (H) until the final voltage is reached. This is largely affected by the discharge current and even more by the discharge rate.
The figure shows an example of discharging characteristics for 0.05C - 3C, the voltage at each end indicating the final discharge voltage. C stands for the nominal capacity.

4.2 Effect of temperature on capacity



The battery capacity is subjected to the influence of temperature and rate of discharge. The capacity increases above 20°C (68°F) and decreases at lower temperature (below 5°C-15°C). High temperature (over 50°C, 122°F) may damage the battery. The rated capacity at 20°C (68°F) is 100%.

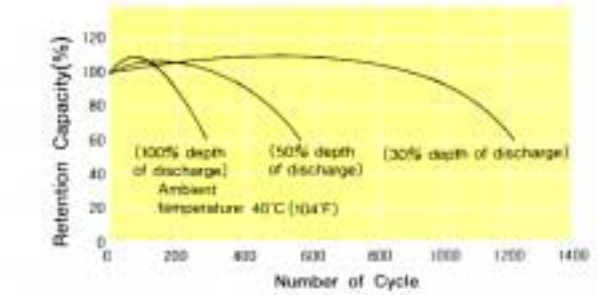
4.3 Shelf life characteristics



The use of a Pb-Ca based alloy grid, results in a very low self-discharge. The average self-discharge rate per day when left charged for 6 months is about 0.1% (by 20°C, 68°F). The figure shows an example of the self-discharge rate at ambient temperature.

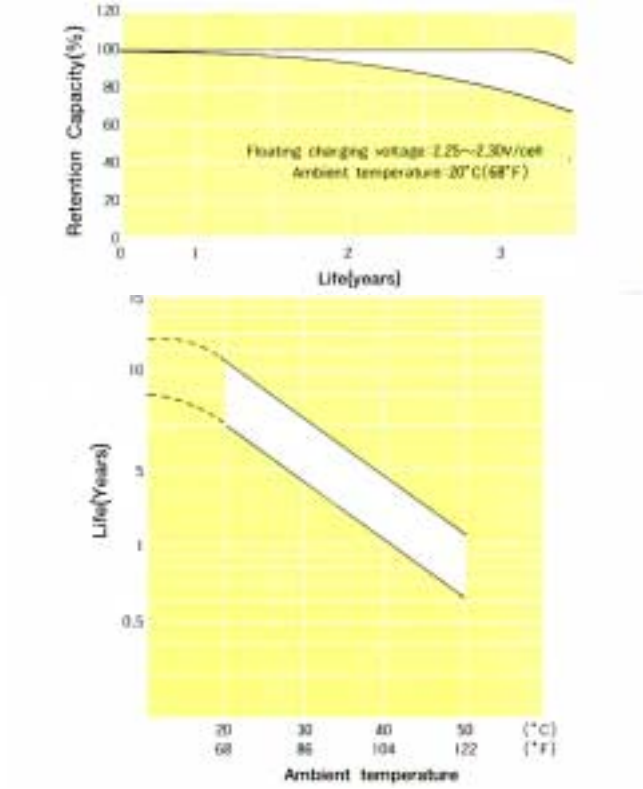
If the battery is not used for a long time, recharge it at least once every 6 months. The table on the next page indicates the recommendable recharge intervals.

4.4 Life characteristics for cyclic use



The number of charge/discharge cycles depends on the discharge rate , the depth of discharge , the operating temperature and the charging method.
The following figure shows the relationship between depth of discharge and the number of cycles.

4.5 Life characteristics for standby use



These figures show the life for floating applications. The width of these characteristics indicates the dispersion. As the life of a battery for floating applications is greatly affected by voltage, charge voltage must be set to 2.25-2.30V/cell.
An appropriate working temperature should be maintained, because it also greatly affects the life of the battery.

5. Specifications

Model	Nominal Voltage (V)	Capacity (Ah)				Weight		Terminal	Internal resistance approx.	Charging Voltage	
		20hr rate (1,75V/cell)	10hr rate (1,75V/cell)	5hr rate (1,75V/cell)	1hr rate (1,75V/cell)	KG	Lbs			Standby use(V)	Cyclic use(V)
59201	6	1.20	1.08	1.02	0.72	0.30	0.66	F1	60	6,75V	7,2V
59202	6	4.00	3.80	3.60	2.40	0.87	1.92	F1	20	to 6,9V	to 7,5V
59206	6	10.00	9.40	9.00	6.00	2.00	4.41	F1	15	(68℉)	(68℉)
59207	12	1.20	1.13	1.10	0.72	0.57	1.26	F1	120		
59208	12	1.90	1.79	1.71	1.14	0.83	1.83	F1	60		
59209	12	3.00	2.73	2.55	1.80	1.10	2.43	F1	50	13,5V	14,4V
59210	12	4.00	3.80	3.60	2.40	1.70	3.75	F1	40	to	to
59211	12	7.00	6.50	6.00	4.60	2.65	5.84	F1	30	13,8V	15V
59213	12	15.00	14.00	13.50	9.00	6.00	13.23	F4	13	at 20℃	at 20℃
59214	12	24.00	23.50	22.50	15.00	8.70	19.20	F4	10	(68℉)	(68℉)
59215	12	40.00	38.00	36.00	24.00	14.00	30.90	F4	8		
59216	12	65.00	61.10	58.50	39.00	22.50	49.60	F4	5		

Model	Dimensions (mm)				Dimensions (inch)				Maximum Discharge current (A)	Ambient temperature			Maximum Charge Current (A)
	L	W	H	TH	L	W	H	TH		charge	discharge	storage	
59201	97	25	51	54	3.82	0.98	1.99	2.13	4.8				0.48
59202	70	47	98	101	2.76	1.85	3.86	3.98	16.0				1.60
59206	151	50	94	98	5.94	1.97	3.70	3.84	40.0				4.00
59207	97	48	51	54	3.82	1.87	1.99	2.13	4.8	0 ℃	-20℃	-20℃	0.48
59208	178	34	60	64	7.01	1.34	2.36	2.52	7.6	(32℉)	(-4℉)	(-4℉)	0.76
59209	79	56	99	102	3.11	2.19	3.88	4.02	12.0	to	to	to	1.20
59210	90	70	102	106	3.54	2.76	4.02	4.15	16.0	40℃	50℃	40℃	1.60
59211	151	65	94	98	5.94	2.56	3.70	3.84	28.0	(104℉)	(122℉)	(104℉)	2.80
59213	181	76	167	167	7.13	2.99	6.57	6.57	60.0				6.00
59214	166	175	125	125	6.54	6.89	4.92	4.92	96.0				9.60
59215	197	165	170	170	7.76	6.50	6.69	6.69	160.0				16.00
59216	350	166	124	124	13.78	6.54	6.85	6.05	269.0				26.00

Fig. 1 Dimensions

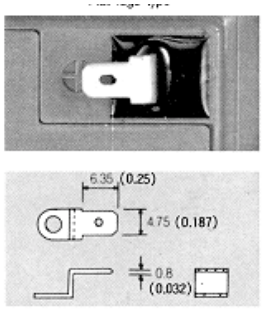


Fig. 2 Terminal F1
White copper
Faston tab 187

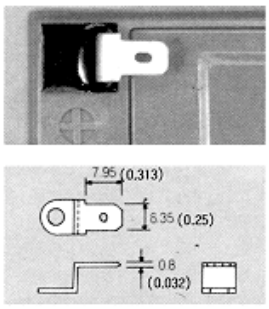


Fig. 3 Terminal F2
White copper
Faston tab 250

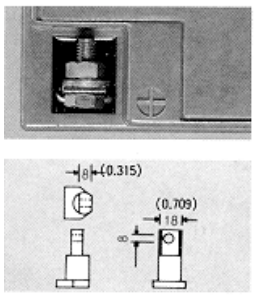


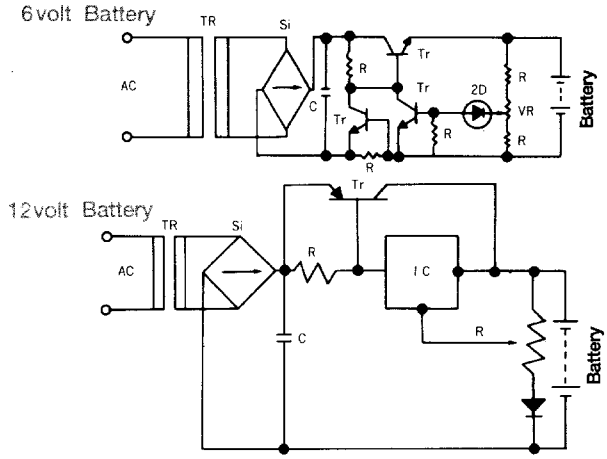
Fig. 4 Terminal F4
Threaded terminal post
both in 5.5mm and 8mm

6. Charging

6.1 Charging method

VABO SLA-BATTERIES are maintenance free. There is no need to add water. Battery performance and service life are greatly affected by the charging method. There are various different charging methods: constant voltage charging, constant current charging, tapered current charging and some combination systems.
VABO SLA-batteries can be charged by any of those methods. However, constant voltage charging combined with limited current is recommended for obtaining maximum capacity and service life together with acceptable recharge times and economy.

6.2 Constant voltage Charging

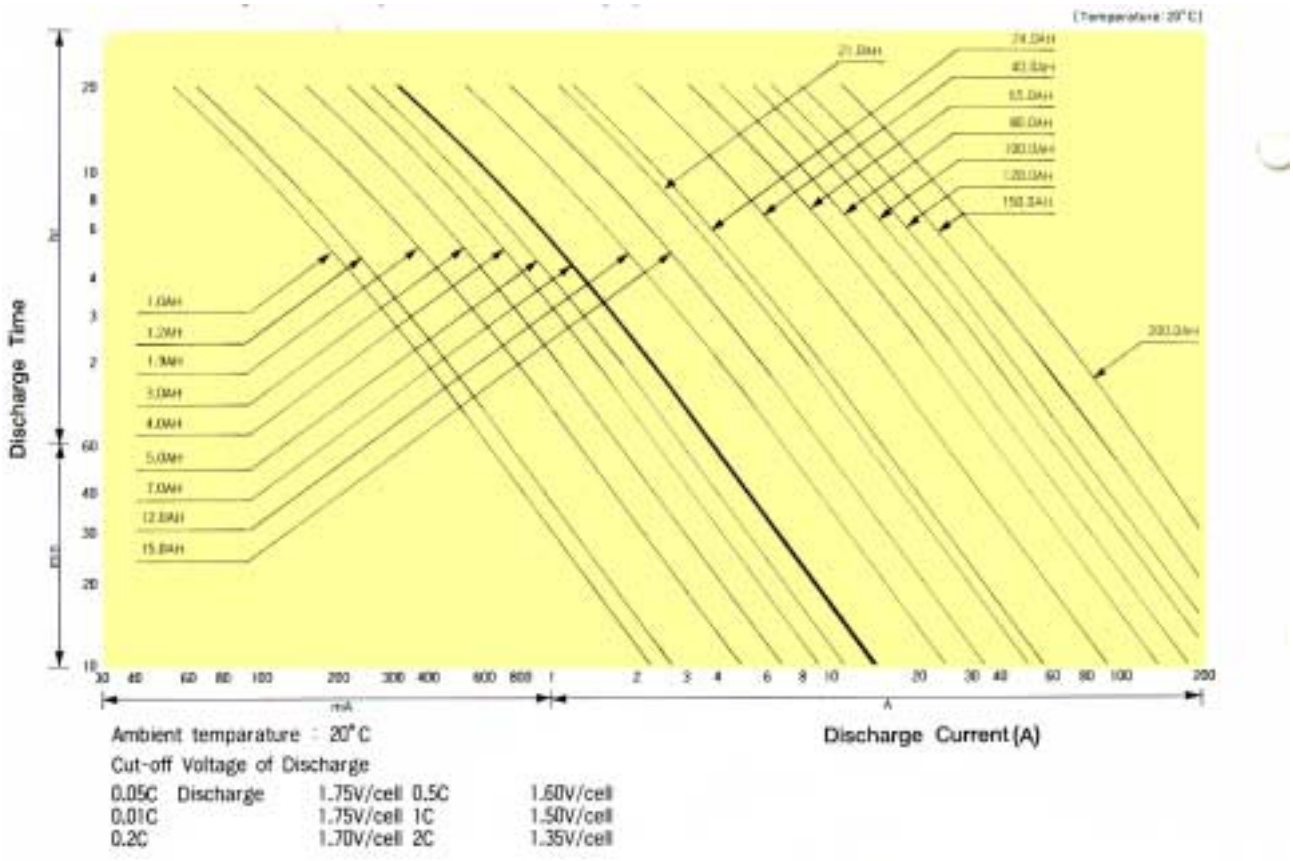


An example of Constant Voltage Charger Circuits

Constant voltage charging is the most suitable and common method. As shown below, this is a charge with constant voltage functions, composed of transformers, transistors, silicon diodes, IC's, etc.... Comparatively large current is used at the initial stage of charging and constant voltage charging is provided at the end period, resulting in an extremely small flow of current.
For cyclic applications charging must be stopped at the lapse of required charging time.

Item	Standby	Cyclic
Setting voltage (V/cell)	2.25-2.30	2.40-2.45
Initial charging current	¼ C(A) or less	¼ C(A) or less
Maximum charging current	40% of rated capacity	40% of rated capacity
Required charging time (hours)	24 or more	10 or more
Ambient temperature	20°C (68°F)	20°C (68°F)

7. How the select the appropriate battery



The capacity for each battery is determined by the size of discharge current and the discharge time. The capacity mentioned on the batteries is the result of a discharge time of 20 hours.
For example, if the discharge current (Load Current) is 1.5A and the requested discharge time is 4 hours, then your best choice is the VABO SLA-battery of 7Ah, although the product of time and load is only 6Ah. The difference is due to the high load current.
Considering the effects of discharge depth to the service life we recommend to use a battery with a sufficient capacity. This battery will have a smaller discharge depth and you will enjoy a longer service life

8. Applications

8.1 Standby applications

- Emergency lighting
- Security and burglar alarm systems
- Telephone and telecommunications equipment
- Automatic fire alarm facilities
- Computer terminals
- UPS systems
- Electronic cash registers
- Electronic equipment

8.2 Cyclic applications

- Portable video tape recorders (VTR)
- Power tools
- Medical electronic equipment
- Measuring instruments
- Portable television
- laboratory equipment
- toys
- material testing machines
- vacuum cleaners
- lighting equipment

9. Handling instructions

9.1 Operation

- Ambient temperature for operation permits in the range of -15°C to 5°C but 5°C to 35°C will extend service life.
- DO NOT install the battery in a location close to any object which give off heat , such as transformers or near fires
- Avoid mixed use of batteries with different capacities, those new and old, or those of different makes because of the difference in characteristics could cause damage to the battery or to other equipment.
- FASTEN the battery securely to protect it from abnormal vibration and shocks during service.
- DO NOT place the batteries in atmosphere of organic solvents or adhesive materials
- DO NOT press and/or bend the terminals
- DO NOT solder connections to the terminals
- Minimum free air space between batteries when use in connecting is 5mm to 10 mm

9.2 Charging

- Follow the specified standards for charging current, charging voltage and charging time.
- Ambient temperature for charging must be within the range of 0°C (32°F) and 40°C (104°F)
- Avoid parallel charging which could cause shortened battery life. If such charging is unavoidable, limit it to two for a maximum.
- Maximum numbers of batteries connectable in series is limited to 18 for 6V type and 9 for 12V type.
- During charging and other occasions, NEVER put the battery in a sealed container or a vinyl bag.

9.3 Discharging

- DO NOT use intermediate taps in cases of batteries connected in series.
- Ambient temperature for discharging must be within the range of -20°C (-4°F) and 50°C (122°F).
- The battery must be immediately charged when it has been incorrectly overdischarged.
- Compared with other battery-systems (Ni-Cad, Ni-Mh) the lead-acid battery systems is very sensitive to overdischarge. Overdischarging results in a failure to recover the normal capacity and may shorten the service life. The VABO SLA-BATTERIES can recover very well after an overdischarge but it is always better to avoid this situation.

9.4 Storage

- To store the battery remove it from the equipment or separate it from the charger or load and keep it in a place that is as dry and low in temperature as possible.
- Ambient temperature for storage must be within the range of -20°C (-4°F) and 40°C (104°F)
- During storage, recharge the battery at least every six months.
- The battery deteriorates even during storage. So it is recommended to use it as early as possible.

9.5 Caution

- DO NOT short-circuit the battery.
- Never access of sparks and flames on or around the battery
- If sulphuric acid from the battery happens to contact with your skin or clothes, immediately wash with water. If it comes in contact with your eyes, wash them with water and immediately consult a doctor for medical care.
- NEVER disassemble the batteries or place them near or in fire.
- DO NOT use in a completely sealed case or container. Any cracks, disformation or other damage on the battery container or cover, etc., or if any leakage of the electrolyte, makes replacement of het battery necessary. Keep the battery clean, wipe it with dry cloth, if necessary, use water dampened cloth. Never use oil, thinner, gasoline, etc.…
- Be sure to recharge the battery after discharging.
- Always read this manual before using the battery.