Vented Lead Acid Standby Battery

OPzS series

OPERATION MANUAL

Version：V1.1

NARADA POWER SOURCE CO., LTD.

Content

Safety and Warning

Please read this manual! It provides very important direction for fix and operation, which can make best capability for the equipment, and elongate the using life.

- For your safety, please do not try to dismantle or open the equipment. The equipment does not contain any spare parts for you. The maintain work can only be done by specially trained service persons.
- As a result of the batteries' latent endanger to health and environment, they should be only changed in our authorization service center. If you need to change the battery or maintain the equipment, please call the nearest service center.
- Batteries can be reclaimed, if it could not be carefully handled, it will do great harms to environment and heath. Please check local laws and regulations to get the validity handle ways or send the equipment to authorized service center.
- The replacement of battery can only be done by persons who know well about the danger and the prevention. When changing the battery, please use the same model and type of sealed lead acid battery.

⚠ Warning—do not smoke or use fire near batteries。

⚠ Warning—do not use organic solvent to wash batteries

⚠ Warning—dot not put batteries into the fire, or it may bombed。

⚠ Warning—do not open batteries, it contains electrolyte, which can hurt the skin and eyes.

⚠ Warning—there may happen shock or short circuit when replacing the batteries. Please operate with tools with insulated handles.

Please take care of the following marks in using

					
Warning	Electricity danger	Protecting your eye	Watch Short-circuits	With adults custody	Do not put batteries into dustbin
					
Read the manual	Fire forbidden	Recycling used	Do not short circuit battery		

Warranty: any of the following action will invalidate the warranty: Non-adherence to the operation manual. Repairs carried out with non-approved spare parts. Application of additives to the electrolyte. Unauthorized interference with the battery.

Chapter one Introduction

1. Feature and Benefit

1.1. Grid: Multiple low antimony lead alloy >> low self-discharge, low water loss and reduce maintenance.

1.2. Positive Plate：Tubular construction>>Active material is not easy to shad, Extra long life.

1.3. Negative Plate: Paste construction.

1.4. Separator: Porous PVC separator and micro-porous rubber separator >> Avoid a short circuit occurrence.

1.5. Case: Transparent resin AS material >> The inside battery can be observed,

Rational case design and saddle bridge structure in bottom >> Can effectively prevent short-circuit for the shed of active material

1.6. Lid: Flame-resistance ABS

1.7. Seal construction: Glue sealed between case and lid.

Mechanical seals and glue seal double structure in post seal >>Ensure no Electrolyte leakage.

1.8. Vent plugs - safety plugs equipped with flame arrestors and anti-acid fog plug. Special vent plugs allowing topping-up without to remove them.

1.9. Connectors - fully insulated, large sectional area copper cable inter-cell connectors reduce voltage drop and measure voltage.

1.10. Capacity range: 200Ah - 2000Ah, C_{10} capacity exceed the DIN standard values.

2. Main application

- Telecommunication system
- Power generation and distribution, Nuclear plant standby power
- Airport and seaport signaling system
- Solar and wind energy system
- Radio and broadcasting station
- Emergency lighting system
- Other standby, cycling system

3. Configuration

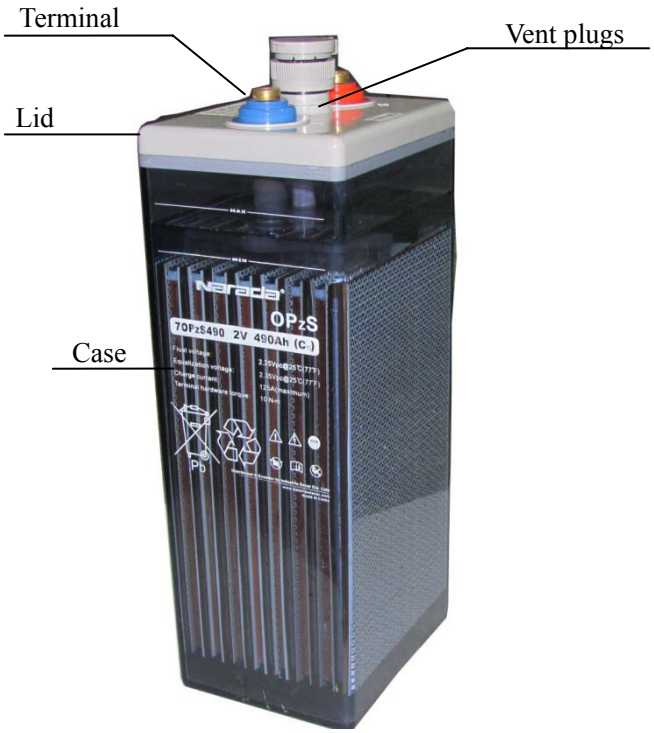

Fig 1-1 Product configuration

4. General Specifications

Table 1-1 General Specifications

Type	Nominal voltage（V）	Nominal capacity C_{10}（Ah）	Nominal Dimensions（mm）				Typical Weight（kg）	
			Length	Width	Height	Height over vent plug	Dry	Acid Filled
4OPzS200	2	200	103	206	355	410	12.8	17.5
5OPzS250	2	250	124	206	355	410	15.1	20.5
6OPzS300	2	300	145	206	355	410	17.5	24.0
5OPzS350	2	350	124	206	471	526	19.8	27.0
6OPzS420	2	420	145	206	471	526	23.0	32.0
7OPzS490	2	490	166	206	471	526	26.2	38.0
6OPzS600	2	600	145	206	646	701	35.3	47.0
8OPzS800	2	800	191	210	646	701	48.2	64.0
10OPzS1000	2	1000	233	210	646	701	58.0	78.0
12OPzS1200	2	1200	275	210	646	701	67.8	92.0
12OPzS1500	2	1500	275	210	773	828	81.7	112.0
16OPzS2000	2	2000	399	214	773	828	119.5	150.0

5. Working Principal

The chemical reaction taking place in lead acid battery is as follows:

$$Pb+PbO_2+2H_2SO_4 \underset{\text{Charge}}{\overset{\text{Discharge}}{\rightleftharpoons}} 2PbSO_4+2H_2O$$

Following reaction takes place in ordinary lead acid battery:

$$2H_2O \longrightarrow 2H_2\uparrow+O_2\uparrow$$

This by-reaction makes water loss gradually and pure water need to be added regularly to keep the battery operate normally. OPzS series is vented battery, water topping is needed.

Chapter Two Technical characteristic

1. Discharge Curve

Fig. 2-1 Discharge Performance Curves at Different Discharge Rates（25℃）

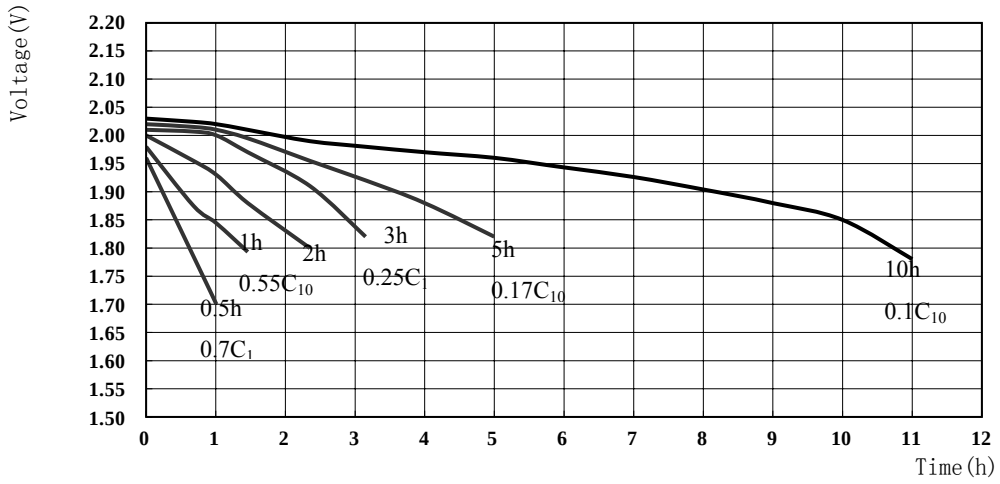

Fig 2-1 Discharge curve

2. Internal resistance and short circuit current

The internal resistance of the battery is a dynamic nonlinear parameter that is continuously changed along with the temperature and discharge state. The internal resistance is the lowest when battery is fully charged. The table 2-2 shows the internal resistance and short circuit current of Narada battery in fully charged state according to the IEC60896 standard. Pay attention to the battery to short-circuit causes the battery voltage to reduce to 0V, and will cause the battery internal component damaged.

Table 2-1 Internal resistance and short circuit current (25℃)

Type	Internal resistance （mΩ）	short circuit current （A）
4OPzS200	0.91	2400
5OPzS250	0.78	2785
6OPzS300	0.68	3180
5OPzS350	0.67	3200
6OPzS420	0.62	3555
7OPzS490	0.56	4065
6OPzS600	0.52	4285
8OPzS800	0.36	6650
10OPzS1000	0.31	7725
12OPzS1200	0.28	8760
12OPzS1500	0.28	8565
16OPzS2000	0.20	12650

Chapter Three Operation and Maintenance

1. Electrolyte

1.1 The electrolyte is diluted sulphuric acid. The nominal electrolyte S.G. at 25℃ is 1.235g/cm^3±0.010g/cm^3.

1.2 Make up electrolyte

a) Pour fixed water into container which should be acid-proof, heat stable, clean.

b) Pour slowly fixed sulphuric acid into water and stir to equality with baton.

Note: Do not pour water into sulphuric acid. Operator should equipped with protective equipment include anti-acid suits, insulated rubber boots, gloves, glasses, hats, masks etc.

1.3 Electrolyte S.G varies with temperature. If temperature is below or above 25℃, specify gravity readings should be corrected. The temperature correction as formula (1),

$$d_{25} = d_t + \alpha(t-25) \quad \text{……(1)}$$

d_{25} —S.G. at 25℃， g/cm^3,

d_t—S.G. at t℃， g/cm^3,

t — the temperature value as achieved S.G. reading, ℃,

α—Temperature factor (see table 3-1).

Table 3-1 Temperature factor

Electrolyte S.G.(g/cm^3)	Temperature factor α
1.180	0.00065
1.205	0.00068
1.210	0.00069
1.215	0.00069
1.225	0.00070
1.235	0.00071
1.240	0.00071
1.400	0.00079

1.4 Fill acid (For a dry-charged battery)

a) Screwing out vent plugs,

b) Get rid of moisture-proof paper tape which stick at bottom of vent plugs,

c) Pour prepared electrolyte into dry battery, the electrolyte temperature should below 30℃ before poured into battery,

d) Adjust electrolyte level 30 min after fill electrolyte,

e) Screw up vent plugs,

f) Initial charging is not needed for a Dry-charged battery, and battery can draw 70% rated capacity at first discharge. Battery capacity increase to 100% rated capacity during operation.

2. Charge battery with constant current (I method)

2.1 First charge

a) Fill acid according to clause 1.4

b) Rest 4 to 6 hours after fill acid, check battery polarity with multimeter and begin to charge battery as temperature below 30℃.

(Note: charge battery after filled acid should less than 12h.

Ensure right and tight connect.

Ensure voltage of DC charger have about 50% higher than nominal voltage of battery bank.

c) Charge current show as table 3-2.

Table 3-2 Charge current with I method (boost charge)

Type	Charge current (A)			
	First charge		Normal charge	
	Step 1	Step 2	Step 1	Step 2
4OPzS200	20	10	20～30	10～15
5OPzS250	25	12.5	25～37.5	12.5～19
6OPzS300	30	15	30～45	15～22.5
5OPzS350	35	17.5	35～52.5	17.5～26
6OPzS420	42	21	42～63	21～31.5
7OPzS490	49	24.5	49～73.5	24.5～37
6OPzS600	60	30	60～90	30～45
8OPzS800	80	40	80～120	40～60
10OPzS1000	100	50	100～150	50～75
12OPzS1200	120	60	120～180	60～90
12OPzS1500	150	75	150～225	75～112
16OPzS2000	200	100	200～300	100～150

The charging must be monitored, first charge have 2 steps. Step 1 charge battery up to 2.40Vpc(about 70% capacity), then switch to step 2.

The battery can be regard as fully charged when reach to any one of below conditions.

a) Cell terminal voltages change no more than 0.05V/h in continuous 2 hours.

b) S.G. of the electrolyte hold constant for 3 to 6 hours.

c) Emitting bubbles from top and bottom of plate are fully.

The charging time can be 6 to 24 hours. If the maximum temperature of 45℃ is exceeded, charging must be terminated, continued at a reduced current, or temporarily switched to float charging.

NOTE: Adjust electrolyte S.G. to 1.240±0.005 g/cm^3(25℃), and fill acid to Max. line.

2.2 Normal charge

Charge battery after first charge and discharge is called Normal charge. Normal charge is also I method, charge current is shown as table 5. Charge capacity is depend on discharge capacity last time, charge 150% capacity of discharge capacity at before 5 time charge, and charge 105% to 130% capacity of discharge capacity after 5 time charge. Adjust electrolyte S.G. to 1.240±0.005 g/cm^3 (25℃), and fill acid to Max. line every two weeds. Battery should be charged no more than 24 hours after discharge.

2.3 Equalization charge

Following condition should carry on equalization charge,

a) Insufficient charged battery

b) Battery Few fully charge and discharge,(Including float charge battery)

c) Battery storage for a long period or after battery plate overhaul.

d) Battery have not charged over 24h after discharge

e) Electric supply is shut down or charger is fault over 15 days and battery discharge over half rated capacity.

Method of Equalization charge

a) Rest 1h after normal charge,
b) Charge battery with current of step 2 of first charge to electrolyte strong bubble,
c) Rest 1 hour
d) Repeat b) to c) 2-3 times to terminal voltage and electrolyte S.G. is constant for 3 hours
e) Rest 1 hour
f) Charge battery continuous.

Electrolytes emit strong bubble immediately as battery is connected to power, then equalization charge is over.

If use IU method, charge battery after normal charge for 30 to 60 hours or charge battery to constant terminal voltage

3. IU method charge (Low constant voltage charge)

3.1 First charge

I method is recommended for first charge, IU method is not recommended for first charge.

3.2 Normal charge

Charge battery with constant voltage 2.30Vpc to 2.35Vpc and limited current 0.10C_{10} to 0.15C_{10} A to fully charge. Fully charged battery is judged according to table3-3, 3-4 and 3-5.

Final charge current value is affected by electrolyte temperature, every 8 ℃ to 10 ℃ electrolyte temperature rise, current value will double. Current values also increase with the battery service life, current will be double when battery near end of life.

Table 3-3 Final charge current of IU method（25℃）

Charge voltage (V/cell)	Current (mA/Ah)
2.25	< 4
2.30	< 7
2.35	< 11

Charge time is related to DOD (depth of discharge), charge voltage and limited current. If limited charge current is 0.1C10~0.15C10 A, please refer to Table 3-4 for charge time.

Table 3-4 Fully charge time vs. DOD

DOD (%)	Charge voltage (V/cell)		
	2.25	2.30	2.35
100	20	18	15
75	18	16	13
50	15	12	10
25	10	7	6
12.5	9	7	6

Please refer to Table 3-5 for fully charge capacity

Table3-5 Fully charge capacity vs. charge voltage with IU method

Charge voltage(V/cell)	Percent of Charge capacity in relation to discharge capacity
2.25	105～110
2.30	110～115
2.35	116～120

Adjust electrolyte S.G. to 1.240±0.005 g/cm3(25℃).

3.3 Float charge

To prolong battery service life, the recommended float charge voltage is 2.23Vpc at 25℃.

4. Adjust electrolyte S.G.

At the end of charge and during operation and, if electrolyte S.G. is different from requirement, electrolyte S.G. should be adjusted as following,

Adjust electrolyte with 1.400 g/cm^3 sulphuric acid or water, calculate as following:

$V = 5V_1 (d_2-d_1)$ ……（2）

V ----needed sulphuric acid or water, L

V1---volume in battery, L

d1 ---required S.G. 1.240g/cm^3（25℃）

d2 ---measure value of S.G., g/cm^3

If $d_2 > d_1$,V is positive number, need add water.

If d2<d1, V is negative number, need add sulphuric acid.

Above formula is suit to electrolyte S.G. from 1.100 to 1.300 g/cm^3.

5. Adjust electrolyte level and temperature

5.1 Adjust electrolyte level if it is not within the min and max line. Adjust electrolyte level to max line after charge.

5.2 Electrolyte temperature should not exceed 40℃ during any charging. Reduce charge current or cool down battery if battery temperature is up to 40℃, Stop charge battery if temperature up to 45℃ and keep on charge battery when temperature below 35℃. Note, rest time (stop charge) should no more than 4 hours.

5.3 Anti-fog plug

Wash plugs (about every 2 years or it is dusty) in clean water and dry them before putting them back on the battery.

6. Operation temperature

The permissible temperature range is 0℃ to 55℃. The recommended temperature range is 10℃ to 30℃. Higher temperatures reduce the operational life. Lower temperatures reduce the available capacity.

To control battery temperature, Space between cells no less than 10mm, setting float voltage and equalization voltage according to this operation manual. Do not expose cells to direct sunlight.

7. Maintenance and Checks

Keep surface of battery clean and dry, avoid leakage current. Clean container with clean water.

Every 6 months, check the total voltage and cell voltage at the battery terminal in all cells. Also check the S.G. and temperature in 10% cells.

Once a year, check voltage and electrolyte S.G. in all cells and check the temperature in 10% cells. Also check a) Tight of connection, b) Installation, c) Ventilation in battery room

8. Storage

The storage site should be clean, ventilated, dry and without direct sunshine. All lead acid batteries lose capacity when standing on open circuit because of self-discharge. The result is that the voltage of open circuit is decreased, and the capacity also decreased. The self-discharge rate is related with ambient temperature. The self-discharge is smaller when the ambient temperature is lower, otherwise is larger. Batteries should be supplementary charged if they have been stored for six months. All batteries, which are ready to store, should be fully charged before storage. It's suggested to record storage time in periodic maintenance record and record the time when another necessary supplementary charge should be made. The quality certificates of OPzS batteries record

the latest charge time of the batteries, next charge time can be calculated according to this charge time.

Dry-batteries must be keep sealed, do not open it during storage.

After-sales Service / Customer Service Hotline

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Annex 1

VRLA Battery Regular Maintenance Record

Type		Place	
Status		Number of battery	
Total Voltage（V）	Current (A)	Temperature	
No.	Voltage（V）	No.	Voltage（V）
1		13	
2		14	
3		15	
4		16	
5		17	
6		18	
7		19	
8		20	
9		21	
10		22	
11		23	
12		24	
Check by sight			
Result:			
Tester:		Date:	