



OPzV-Technical Manual

VRLA Tubular Gel Battery



Shenzhen UPSEN Electric CO., Ltd.

UPSEN Tubular Gel Battery Instruction (2V Series)

1. Company Profile:

UPSEN Power Corp.(UPSEN) is a Chinese Sealed Lead Acid (SLA) battery company founded in 2002,UPSEN designs, develops, manufactures and sells environmentally friendly Sealed Lead Acid battery. UPSen introduces overseas advanced technology and adopts the world's most advanced production equipments and testing measures to ensure product's long service life and high energy density. Environmental protection features like cadmium-free is leading in the domestic counterparts.

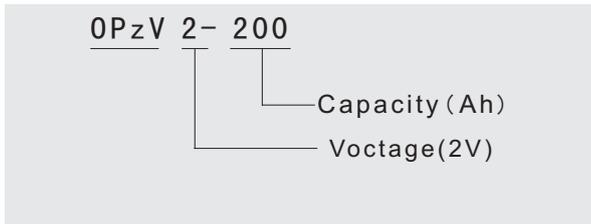
UPSEN is a high-tech enterprise headquartered in Baoan District, Shenzhen, China, and has two manufacturing bases in Shenzhen and Hengyang, with over 2000 employees.

UPSEN has obtained ISO9001(Quality Control), OHSAS18001 (Occupational Health and Safety), ISO14001 (Environmental Control), UL and CE certificates, and got state approval from Chinese government departments of electricity, telecommunication and army.

2. Product Standard and Item Number

UPSEN OPzV Tubular GEL battery adopts Germany DIN40742 and IEC60896-21/22 standard, product capacity ranges from 200AH to 3000AH.

OPzV battery is single cell construction, nominal voltage is 2V, take OPzV2-200 for example, "OPzV" means stationary valve-regulated Sealed Gel battery, "200" means the battery capacity 200AH.



OPzV2-200 Model Definition

3. Principle of Operation

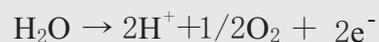
The OPzV battery's chemical reaction is as below:



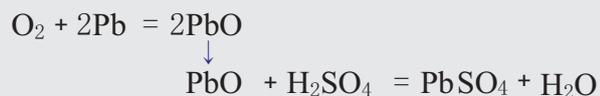
During the later period of charging or over-charged the positive will generate hydrogen, and negative will generate oxygen. The negative plates adopts high purity Pb-Ca alloy in order to inhibit the generation of hydrogen, OPzV battery adopt unique GEL electrolyte technology, the Gel-forming material forms three-dimensional porous construction which provide many small gap during the later period of charging. The oxygen generated by positive reach negative through these gaps and reacts with spongy Pb generating H₂O which go back to the battery.. During this process the battery doesn' t lose any H₂O, it' s sealed and maintenance free.

Oxygen recombination process is as below:

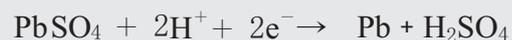
Step 1: During the later period of charging or over-charged the positive will generate hydrogen:



Step 2: The oxygen generated by positive reach negative through these gaps and reacts with spongy Pb generating H₂O which go back to the battery.



Step 3: Lead sulfate generated by negative generate lead and sulfuric acid.



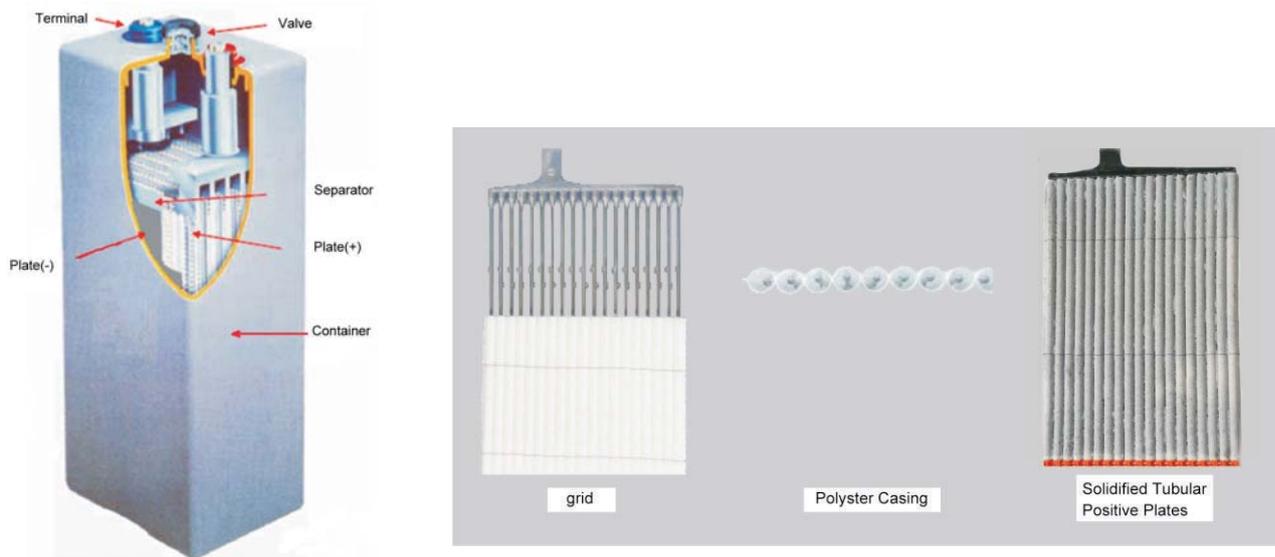
4. Applications:

- Solar Energy & Wind Energy
- IT/Telecommunications
- Electric Vehicle, Floor Machines, Marine, Touring Coach
- Power Storage Plant
- Uninterruptible Power Supplier/UPS
- Security/Emergency lighting



5. Product Features

1. Battery Construction(&Position Plate Design)



2. Features

- **Electrolyte:** Immobilized in a GEL structure comprises Germany classic quality fumed SiO₂ full packed battery interior space (under the strap).
No Leakage & stable gel-electrolyte in high safety
- **Positive Electrode:** Tubular positive plates made by die-casting technical and use patent Pb-Ca alloy with highly porous gauntlets that retain the active material, efficiently prevent active material shedding, good corrosiveness resistance, offer an extreme high cyclic expectancy and with long design life more than 20 years.
- **Negative Electrode:** Formed pasted plate in radial porous gauntlets structure makes high utilization of active material and incorporating a special Pb-Ca grid alloy make advantage performance in high current discharge & lower internal resistance.
- **Separators:** Adopt microporous & lower internal resistance PVC-SiO₂ separators import from Euro.
- **Polar:** The Polar consists of Copper-insert M8 terminal with a very low resistance which both mechanize sealed and epoxy resin sealed, this sealing structure have good performance of sealing and longer service life.
- **Container:** The battery container is made of high strength ABS. Container and lid are sealed together by epoxy resin. The special epoxy resin insure reliable sealing performance in service life.
- **Safety Valve:** High sensitivity safety valve, stable performance in flip-top vent plugs press, cooperated with flame arester make battery more safe and high recombination efficiency.

6. Products Advantage

- Environmental Friendly
- Widely Operating Temperature Range and stable performance of lower/higher temperature resistance.
- Very good performance in small current discharge and deep discharge recovery, which it is much suitable for PSOC environments.
- Super long service life
- Safety valve is explosion proof.
- Lowest self discharge characteristic and high reliability
- More safe compare to AGM battery

7. Technical Specification

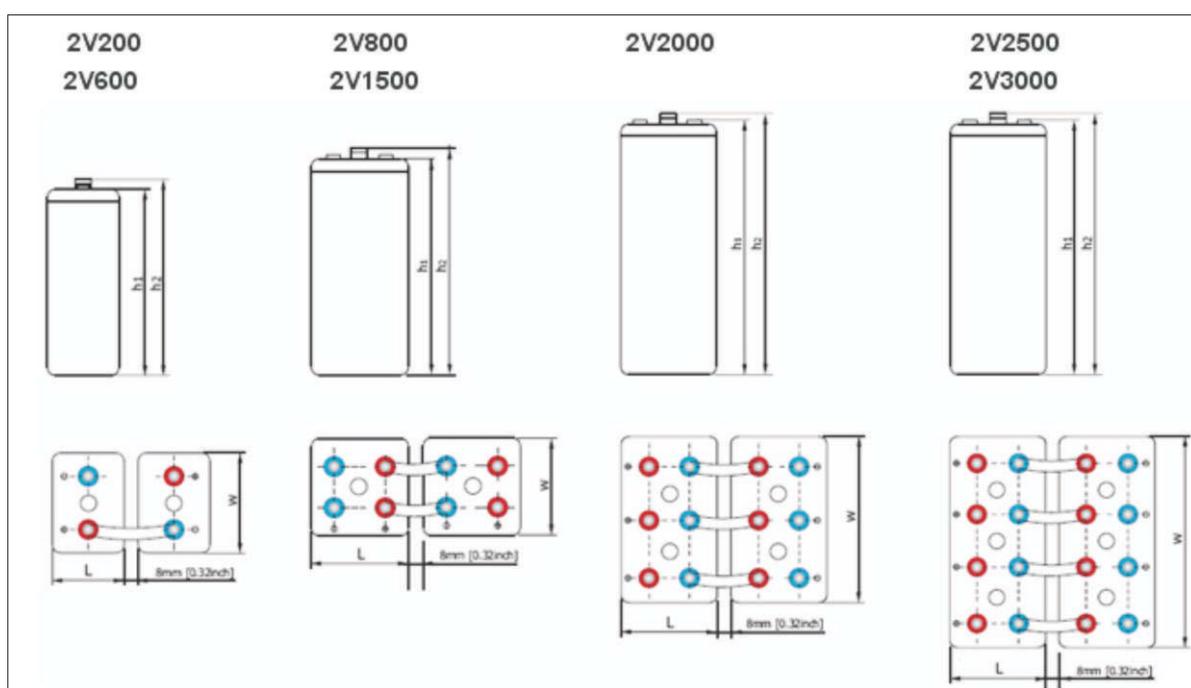
- ☆ Designed Floating Life ≥ 20 years at 25°C
- ☆ Longer Cyclic Life, 80%DOD ≥ 1200 cycles
- ☆ Lowest self discharge < 2% per month
- ☆ Super recovery capability from deep discharge
- ☆ Recombination efficiency of gas more than 99%(2 months float use)
- ☆ Charge Voltage(25°C)
 - Equalize charge: 2.35V/cell
 - Float Use: 2.25 ~ 2.27V/cell
- ☆ Max. Discharge Current ≤ 2110
- ☆ Operating Temperature Range
 - Max. Range: -40°C ~ +70°C
 - Advise Range: 25±5°C
- ☆ Relative humidity $\leq 95\%$
- ☆ Altitude $\leq 4000\text{m}$
- ☆ Away from any source of ignition, organic solvent, avoid direct sunlight.
- ☆ Keep consistent ambient temperature about $\leq 3^\circ\text{C}$ of each battery bank

8. Product Parameters and Drawing

1.OPzV Battery Parameters

Model No.	Voltage (V)	Capacity (Ah)	Pole	Dimension				Weight (Kg)
				Length (mm)	Width (mm)	Height (mm)	Total Height (mm)	
OPzV2-200	2	200	1	103	206	354	397	18
OPzV2-250	2	250	1	124	206	354	397	22
OPzV2-300	2	300	1	145	206	354	397	25
OPzV2-350	2	350	1	124	206	470	513	29
OPzV2-420	2	420	1	145	206	470	513	33
OPzV2-500	2	500	1	166	206	470	513	39
OPzV2-600	2	600	1	145	206	645	687	48
OPzV2-770	2	770	1	253	210	470	513	56
OPzV2-800	2	800	2	191	210	645	687	64
OPzV2-1000	2	1000	2	233	210	645	687	75
OPzV2-1200	2	1200	2	275	210	645	687	90
OPzV2-1500	2	1500	2	275	210	795	836	110
OPzV2-2000	2	2000	3	399	212	772	813	150
OPzV2-2500	2	2500	4	487	212	772	813	190
OPzV2-3000	2	3000	4	576	212	772	813	220

2.OPzV Battery Drawing with Terminal Position



3. Conductance, Internal Resistance and Short Circuit Current

The conductance and resistance decrease with the capacity increasing, it's a dynamic parameter instead of a linear one. It change with temperature and SOC(state of charge), the resistance is the smallest when it's fully charged, while conductance is the biggest at this time. The values listed in the form are based on the same condition.(temperature is about 25°C.

Note: When measuring the conductance or resistance, the deviation may happen if the measuring tools sensitivity is different or the tools are from different manufacturers, the following values are based on battery fully charged and in accordance with IEC60896-21/22, for reference only.

Conductance, Internal Resistance and Short Circuit Current

Model No.	Conductance (S)	Internal Resistance (mΩ)	Short Circuit Current (A)
OPzV2-200	1520	0.60	3410
OPzV2-250	1825	0.57	4000
OPzV2-300	2120	0.55	4550
OPzV2-350	2230	0.42	4850
OPzV2-420	2400	0.38	5400
OPzV2-500	2720	0.35	6000
OPzV2-600	2900	0.33	6200
OPzV2-770	3050	0.31	6440
OPzV2-800	3210	0.30	6800
OPzV2-1000	3650	0.27	7900
OPzV2-1200	3980	0.25	8200
OPzV2-1500	4155	0.23	8500
OPzV2-2000	4545	0.22	9300
OPzV2-2500	5030	0.20	10300
OPzV2-3000	5260	0.19	10700

9. Technical Parameters

1, Constant Current Discharge Characteristics: Amps

Final Voltage at 1.90V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPZV2-200	126.0	96.00	64.00	47.14	38.00	32.43	29.20	22.70	19.40
OPZV2-250	157.5	120.0	80.00	58.93	47.50	40.54	36.50	28.37	24.25
OPzV2-300	189.0	144.0	96.00	70.71	57.00	48.65	43.80	34.05	29.10
OPzV2-350	220.5	168.0	112.0	82.50	66.50	56.75	51.10	39.72	33.95
OPzV2-420	264.6	201.6	134.4	99.00	79.80	68.11	61.32	47.67	40.74
OPzV2-500	315.0	240.0	160.0	117.9	95.00	81.08	73.00	56.75	48.50
OPZV2-600	378.0	288.0	192.0	141.4	114.0	97.29	87.60	68.09	58.20
OPZV2-770	485.1	369.6	246.4	181.5	146.3	124.9	112.4	87.39	74.69
OPZV2-800	504.0	384.0	256.0	188.6	152.0	129.7	116.8	90.79	77.60
OPZV2-1000	630.0	480.0	320.0	235.7	190.0	162.2	146.0	113.5	97.00
OPZV2-1200	756.0	576.0	384.0	282.9	228.0	194.6	175.2	136.2	116.4
OPZV2-1500	945.0	720.0	480.0	353.6	285.0	243.2	219.0	170.2	145.5
OPZV2-2000	1260	960.0	640.0	471.4	380.0	324.3	292.0	227.0	194.0
OPZV2-2500	1575	1200	800.0	589.3	475.0	405.4	365.0	283.7	242.5
OPZV2-3000	1890	1440	960.0	707.1	570.0	486.5	438.0	340.5	291.0

Terminal Discharge Volt at 1.87V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	110.0	86.00	59.00	44.23	36.10	31.09	28.20	21.73	18.60
OPzV2-250	137.5	107.5	73.75	55.29	45.13	38.86	35.25	27.16	23.25
OPzV2-300	165.0	129.0	88.50	66.35	54.15	46.63	42.30	32.59	27.90
OPzV2-350	192.5	150.5	103.3	77.41	63.18	54.40	49.35	38.02	32.55
OPzV2-420	231.0	180.6	123.9	92.89	75.81	65.28	59.22	45.63	39.06
OPzV2-500	275.0	215.0	147.5	110.6	90.25	77.72	70.50	54.32	46.50
OPzV2-600	330.0	258.0	177.0	132.7	108.3	93.26	84.60	65.18	55.80
OPzV2-770	423.5	331.1	227.2	170.3	139.0	119.7	108.6	83.65	71.61
OPzV2-800	440.0	344.0	236.0	176.9	144.4	124.4	112.8	86.91	74.40
OPzV2-1000	550.0	430.0	295.0	221.2	180.5	155.4	141.0	108.6	93.00
OPzV2-1200	660.0	516.0	354.0	265.4	216.6	186.5	169.2	130.4	111.6
OPzV2-1500	825.0	645.0	442.5	331.7	270.8	233.2	211.5	163.0	139.5
OPzV2-2000	1100	860.0	590.0	442.3	361.0	310.9	282.0	217.3	186.0
OPzV2-2500	1375	1075	737.5	552.9	451.3	388.6	352.5	271.6	232.5
OPzV2-3000	1650	1290	885.0	663.5	541.5	466.3	423.0	325.9	279.0

Terminal Discharge Volt at 1.83V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	126.0	96.00	64.00	47.14	38.00	32.43	29.20	22.70	19.40
OPzV2-250	157.5	120.0	80.00	58.93	47.50	40.54	36.50	28.37	24.25
OPzV2-300	189.0	144.0	96.00	70.71	57.00	48.65	43.80	34.05	29.10
OPzV2-350	220.5	168.0	112.0	82.50	66.50	56.75	51.10	39.72	33.95
OPzV2-420	264.6	201.6	134.4	99.00	79.80	68.11	61.32	47.67	40.74
OPzV2-500	315.0	240.0	160.0	117.9	95.00	81.08	73.00	56.75	48.50
OPzV2-600	378.0	288.0	192.0	141.4	114.0	97.29	87.60	68.09	58.20
OPzV2-770	485.1	369.6	246.4	181.5	146.3	124.9	112.4	87.39	74.69
OPzV2-800	504.0	384.0	256.0	188.6	152.0	129.7	116.8	90.79	77.60
OPzV2-1000	630.0	480.0	320.0	235.7	190.0	162.2	146.0	113.5	97.00
OPzV2-1200	756.0	576.0	384.0	282.9	228.0	194.6	175.2	136.2	116.4
OPzV2-1500	945.0	720.0	480.0	353.6	285.0	243.2	219.0	170.2	145.5
OPzV2-2000	1260	960.0	640.0	471.4	380.0	324.3	292.0	227.0	194.0
OPzV2-2500	1575	1200	800.0	589.3	475.0	405.4	365.0	283.7	242.5
OPzV2-3000	1890	1440	960.0	707.1	570.0	486.5	438.0	340.5	291.0

Terminal Discharge Volt at 1.80V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	140.0	104.0	66.40	48.50	38.76	33.20	30.00	23.28	20.00
OPzV2-250	175.0	130.0	83.00	60.63	48.45	41.50	37.50	29.10	25.00
OPzV2-300	210.0	156.0	99.60	72.75	58.14	49.80	45.00	34.92	30.00
OPzV2-350	245.0	182.0	116.2	84.88	67.83	58.10	52.50	40.74	35.00
OPzV2-420	294.0	218.4	139.4	101.9	81.40	69.72	63.00	48.89	42.00
OPzV2-500	350.0	260.0	166.0	121.3	96.90	83.00	75.00	58.20	50.00
OPzV2-600	420.0	312.0	199.2	145.5	116.3	99.60	90.00	69.84	60.00
OPzV2-770	539.0	400.4	255.6	186.7	149.2	127.8	115.5	89.63	77.00
OPzV2-800	560.0	416.0	265.6	194.0	155.0	132.8	120.0	93.12	80.00
OPzV2-1000	700.0	520.0	332.0	242.5	193.8	166.0	150.0	116.4	100.0
OPzV2-1200	840.0	624.0	398.4	291.0	232.6	199.2	180.0	139.7	120.0
OPzV2-1500	1050	780.0	498.0	363.8	290.7	249.0	225.0	174.6	150.0
OPzV2-2000	1400	1040	664.0	485.0	387.6	332.0	300.0	232.8	200.0
OPzV2-2500	1750	1300	830.0	606.3	484.5	415.0	375.0	291.0	250.0
OPzV2-3000	2100	1560	996.0	727.5	581.4	498.0	450.0	349.2	300.0

Terminal Discharge Volt at 1.75V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	156.0	111.4	69.40	50.44	39.40	34.00	30.60	23.67	20.40
OPzV2-250	195.0	139.3	86.75	63.05	49.25	42.50	38.25	29.59	25.50
OPzV2-300	234.0	167.1	104.1	75.66	59.10	51.00	45.90	35.50	30.60
OPzV2-350	273.0	195.0	121.5	88.27	68.95	59.50	53.55	41.42	35.70
OPzV2-420	327.6	233.9	145.7	105.9	82.74	71.40	64.26	49.70	42.84
OPzV2-500	390.0	278.5	173.5	126.1	98.50	85.00	76.50	59.17	51.00
OPzV2-600	468.0	334.2	208.2	151.3	118.2	102.00	91.80	71.00	61.20
OPzV2-770	600.6	428.9	267.2	194.2	151.7	130.9	117.8	91.12	78.54
OPzV2-800	624.0	445.6	277.6	201.8	157.6	136.0	122.4	94.67	81.60
OPzV2-1000	780.0	557.0	347.0	252.2	197.0	170.0	153.0	118.3	102.0
OPzV2-1200	936.0	668.4	416.4	302.6	236.4	204.0	183.6	142.0	122.4
OPzV2-1500	1170	835.5	520.5	378.3	295.5	255.0	229.5	177.5	153.0
OPzV2-2000	1560	1114	694.0	504.4	394.0	340.0	306.0	236.7	204.0
OPzV2-2500	1950	1393	867.5	630.5	492.5	425.0	382.5	295.9	255.0
OPzV2-3000	2340	1671	1041	756.6	591.0	510.0	459.0	355.0	306.0

Terminal Discharge Volt at 1.70V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	172.0	115.0	71.40	51.41	40.09	34.40	31.00	23.86	20.60
OPzV2-250	215.0	143.8	89.25	64.26	50.11	43.00	38.75	29.83	25.75
OPzV2-300	258.0	172.5	107.1	77.12	60.14	51.60	46.50	35.79	30.90
OPzV2-350	301.0	201.3	125.0	89.97	70.16	60.20	54.25	41.76	36.05
OPzV2-420	361.2	241.5	149.9	108.0	84.19	72.24	65.10	50.11	43.26
OPzV2-500	430.0	287.5	178.5	128.5	100.2	86.00	77.50	59.66	51.50
OPzV2-600	516.0	345.0	214.2	154.2	120.3	103.20	93.00	71.59	61.80
OPzV2-770	662.2	442.8	274.9	197.9	154.3	132.4	119.4	91.87	79.31
OPzV2-800	688.0	460.0	285.6	205.6	160.4	137.6	124.0	95.45	82.40
OPzV2-1000	860.0	575.0	357.0	257.1	200.5	172.0	155.0	119.3	103.0
OPzV2-1200	1032	690.0	428.4	308.5	240.5	206.4	186.0	143.2	123.6
OPzV2-1500	1290	862.5	535.5	385.6	300.7	258.0	232.5	179.0	154.5
OPzV2-2000	1720	1150	714.0	514.1	400.9	344.0	310.0	238.6	206.0
OPzV2-2500	2150	1438	892.5	642.6	501.1	430.0	387.5	298.3	257.5
OPzV2-3000	2580	1725	1071.0	771.2	601.4	516.0	465.0	357.9	309.0

Terminal Discharge Volt at 1.65V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	177.4	122.2	73.80	52.80	40.66	34.80	31.40	24.06	20.80
OPzV2-250	221.8	152.8	92.25	66.00	50.83	43.50	39.25	30.07	26.00
OPzV2-300	266.1	183.3	110.7	79.20	60.99	52.20	47.10	36.08	31.20
OPzV2-350	310.5	213.9	129.2	92.40	71.16	60.90	54.95	42.10	36.40
OPzV2-420	372.5	256.6	155.0	110.9	85.39	73.08	65.94	50.52	43.68
OPzV2-500	443.5	305.5	184.5	132.0	101.7	87.00	78.50	60.14	52.00
OPzV2-600	532.2	366.6	221.4	158.4	122.0	104.4	94.20	72.17	62.40
OPzV2-770	683.0	470.5	284.1	203.3	156.5	134.0	120.9	92.62	80.08
OPzV2-800	709.6	488.8	295.2	211.2	162.6	139.2	125.6	96.22	83.20
OPzV2-1000	887.0	611.0	369.0	264.0	203.3	174.0	157.0	120.3	104.0
OPzV2-1200	1064	733.2	442.8	316.8	244.0	208.8	188.4	144.3	124.8
OPzV2-1500	1331	916.5	553.5	396.0	305.0	261.0	235.5	180.4	156.0
OPzV2-2000	1774	1222	738.0	528.0	406.6	348.0	314.0	240.6	208.0
OPzV2-2500	2218	1528	922.5	660.0	508.3	435.0	392.5	300.7	260.0
OPzV2-3000	2661	1833	1107	792.0	609.9	522.0	471.0	360.8	312.0

Terminal Discharge Volt at 1.60V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	185.0	126.4	76.60	55.00	41.80	35.40	31.80	24.25	21.00
OPzV2-250	231.3	158.0	95.75	68.75	52.25	44.25	39.75	30.31	26.25
OPzV2-300	277.5	189.6	114.9	82.50	62.70	53.10	47.70	36.38	31.50
OPzV2-350	323.8	221.2	134.1	96.25	73.15	61.95	55.65	42.44	36.75
OPzV2-420	388.5	265.4	160.9	115.5	87.78	74.34	66.78	50.93	44.10
OPzV2-500	462.5	316.0	191.5	137.5	104.5	88.50	79.50	60.63	52.50
OPzV2-600	555.0	379.2	229.8	165.0	125.4	106.2	95.40	72.75	63.00
OPzV2-770	712.3	486.6	294.9	211.8	160.9	136.3	122.4	93.36	80.85
OPzV2-800	740.0	505.6	306.4	220.0	167.2	141.6	127.2	97.00	84.00
OPzV2-1000	925.0	632.0	383.0	275.0	209.0	177.0	159.0	121.3	105.0
OPzV2-1200	1110	758.4	459.6	330.0	250.8	212.4	190.8	145.5	126.0
OPzV2-1500	1388	948.0	574.5	412.5	313.5	265.5	238.5	181.9	157.5
OPzV2-2000	1850	1264	766.0	550.0	418.0	354.0	318.0	242.5	210.0
OPzV2-2500	2313	1580	957.5	687.5	522.5	442.5	397.5	303.1	262.5
OPzV2-3000	2775	1896	1149	825.0	627.0	531.0	477.0	363.8	315.0

2.Constant Power Discharge Characteristics: Watts

Terminal Discharge Volt at 1.90V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	188.3	149.7	106.3	80.80	66.93	58.20	52.60	41.52	36.28
OPzV2-250	235.4	187.2	132.9	101.0	83.67	72.75	65.75	51.90	45.35
OPzV2-300	282.5	224.6	159.5	121.2	100.4	87.30	78.90	62.27	54.42
OPzV2-350	329.6	262.1	186.1	141.4	117.1	101.9	92.05	72.65	63.49
OPzV2-420	395.5	314.5	223.3	169.7	140.6	122.2	110.5	87.18	76.18
OPzV2-500	470.8	374.4	265.8	202.0	167.3	145.5	131.5	103.8	90.70
OPzV2-600	565.0	449.2	319.0	242.4	200.8	174.6	157.8	124.5	108.8
OPzV2-770	725.1	576.5	409.4	311.1	257.7	224.1	202.5	159.8	139.7
OPzV2-800	753.3	599.0	425.3	323.2	267.7	232.8	210.4	166.1	145.1
OPzV2-1000	941.7	748.7	531.6	404.0	334.7	291.0	263.0	207.6	181.4
OPzV2-1200	1130	898.5	638.0	484.8	401.6	349.2	315.6	249.1	217.7
OPzV2-1500	1413	1123	797.5	606.0	502.0	436.5	394.5	311.4	272.1
OPzV2-2000	1883	1497	1063	808.0	669.3	582.0	526.0	415.2	362.8
OPzV2-2500	2354	1872	1329	1010	836.7	727.5	657.5	519.0	453.5
OPzV2-3000	2825	2246	1595	1212	1004	873.0	789.0	622.7	544.2

Terminal Discharge Volt at 1.87V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	207.2	162.6	112.8	84.62	70.55	61.00	55.60	43.26	37.83
OPzV2-250	259.0	203.3	141.0	105.8	88.19	76.25	69.50	54.08	47.29
OPzV2-300	310.8	243.9	169.1	126.9	105.8	91.50	83.40	64.89	56.75
OPzV2-350	362.7	284.6	197.3	148.1	123.5	106.8	97.30	75.71	66.20
OPzV2-420	435.2	341.5	236.8	177.7	148.2	128.1	116.8	90.85	79.44
OPzV2-500	518.1	406.5	281.9	211.6	176.4	152.5	139.0	108.2	94.58
OPzV2-600	621.7	487.8	338.3	253.9	211.7	183.0	166.8	129.8	113.5
OPzV2-770	797.8	626.0	434.1	325.8	271.6	234.9	214.1	166.6	145.6
OPzV2-800	828.9	650.4	451.0	338.5	282.2	244.0	222.4	173.0	151.3
OPzV2-1000	1036	813.0	563.8	423.1	352.8	305.0	278.0	216.3	189.2
OPzV2-1200	1243	975.7	676.6	507.7	423.3	366.0	333.6	259.6	227.0
OPzV2-1500	1554	1220	845.7	634.7	529.1	457.5	417.0	324.5	283.7
OPzV2-2000	2072	1626	1128	846.2	705.5	610.0	556.0	432.6	378.3
OPzV2-2500	2590	2033	1410	1058	881.9	762.5	695.0	540.8	472.9
OPzV2-3000	3108	2439	1691	1269	1058	915.0	834.0	648.9	567.5

Terminal Discharge Volt at 1.83V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	232.2	177.3	120.0	89.04	73.97	63.40	57.40	44.81	39.19
OPzV2-250	290.2	221.6	150.0	111.3	92.46	79.25	71.75	56.02	48.99
OPzV2-300	348.2	265.9	180.0	133.6	111.0	95.10	86.10	67.22	58.78
OPzV2-350	406.3	310.2	210.0	155.8	129.4	111.0	100.5	78.42	68.58
OPzV2-420	487.5	372.3	252.0	187.0	155.3	133.1	120.5	94.11	82.29
OPzV2-500	580.4	443.2	300.0	222.6	184.9	158.5	143.5	112.0	97.97
OPzV2-600	696.5	531.8	360.0	267.1	221.9	190.2	172.2	134.4	117.6
OPzV2-770	893.8	682.5	462.0	342.8	284.8	244.1	221.0	172.5	150.9
OPzV2-800	928.6	709.1	480.0	356.2	295.9	253.6	229.6	179.3	156.8
OPzV2-1000	1161	886.4	600.0	445.2	369.8	317.0	287.0	224.1	195.9
OPzV2-1200	1393	1064	720.0	534.3	443.8	380.4	344.4	268.9	235.1
OPzV2-1500	1741	1330	900.0	667.8	554.8	475.5	430.5	336.1	293.9
OPzV2-2000	2322	1773	1200	890.4	739.7	634.0	574.0	448.1	391.9
OPzV2-2500	2902	2216	1500	1113	924.6	792.5	717.5	560.2	489.9
OPzV2-3000	3482	2659	1800	1336	1110	951.0	861.0	672.2	587.8

Terminal Discharge Volt at 1.80V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	253.7	189.1	124.0	91.05	75.38	64.80	58.80	45.78	40.16
OPzV2-250	317.1	236.4	155.0	113.8	94.22	81.00	73.50	57.23	50.20
OPzV2-300	380.5	283.7	186.0	136.6	113.1	97.20	88.20	68.68	60.24
OPzV2-350	443.9	331.0	217.0	159.3	131.9	113.4	102.9	80.12	70.28
OPzV2-420	532.7	397.2	260.4	191.2	158.3	136.1	123.5	96.15	84.33
OPzV2-500	634.2	472.9	310.0	227.6	188.4	162.0	147.0	114.5	100.4
OPzV2-600	761.0	567.4	372.1	273.2	226.1	194.4	176.4	137.4	120.5
OPzV2-770	976.6	728.2	477.5	350.6	290.2	249.5	226.4	176.3	154.6
OPzV2-800	1015	756.6	496.1	364.2	301.5	259.2	235.2	183.1	160.6
OPzV2-1000	1268	945.7	620.1	455.3	376.9	324.0	294.0	228.9	200.8
OPzV2-1200	1522	1135	744.1	546.3	452.3	388.8	352.8	274.7	240.9
OPzV2-1500	1902	1419	930.1	682.9	565.3	486.0	441.0	343.4	301.2
OPzV2-2000	2537	1891	1240	910.5	753.8	648.0	588.0	457.8	401.6
OPzV2-2500	3171	2364	1550	1138	942.2	810.0	735.0	572.3	502.0
OPzV2-3000	3805	2837	1860	1366	1131	972.0	882.0	686.8	602.4

Terminal Discharge Volt at 1.75V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	275.2	197.6	128.0	93.87	76.38	66.40	59.80	46.37	40.74
OPzV2-250	344.0	247.0	160.0	117.3	95.48	83.00	74.75	57.96	50.93
OPzV2-300	412.8	296.4	192.1	140.8	114.6	99.60	89.70	69.55	61.11
OPzV2-350	481.5	345.8	224.1	164.3	133.7	116.2	104.7	81.14	71.30
OPzV2-420	577.9	414.9	268.9	197.1	160.4	139.4	125.6	97.37	85.55
OPzV2-500	687.9	494.0	320.1	234.7	191.0	166.0	149.5	115.9	101.9
OPzV2-600	825.5	592.7	384.1	281.6	229.1	199.2	179.4	139.1	122.2
OPzV2-770	1059	760.7	492.9	361.4	294.1	255.6	230.2	178.5	156.8
OPzV2-800	1101	790.3	512.1	375.5	305.5	265.6	239.2	185.5	163.0
OPzV2-1000	1376	987.9	640.2	469.3	381.9	332.0	299.0	231.8	203.7
OPzV2-1200	1651	1185	768.2	563.2	458.3	398.4	358.8	278.2	244.4
OPzV2-1500	2064	1482	960.3	704.0	572.9	498.0	448.5	347.7	305.6
OPzV2-2000	2752	1976	1280	938.7	763.8	664.0	598.0	463.7	407.4
OPzV2-2500	3440	2470	1600	1173	954.8	830.0	747.5	579.6	509.3
OPzV2-3000	4128	2964	1921	1408	1146	996.0	897.0	695.5	611.1

Terminal Discharge Volt at 1.70V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	295.1	199.6	131.3	95.48	77.59	67.00	60.40	46.75	41.13
OPzV2-250	368.8	249.5	164.1	119.3	96.98	83.75	75.50	58.44	51.41
OPzV2-300	442.6	299.4	196.9	143.2	116.4	100.5	90.60	70.13	61.69
OPzV2-350	516.4	349.3	229.7	167.1	135.8	117.3	105.7	81.82	71.97
OPzV2-420	619.6	419.1	275.6	200.5	162.9	140.7	126.8	98.18	86.37
OPzV2-500	737.7	499.0	328.1	238.7	194.0	167.5	151.0	116.9	102.8
OPzV2-600	885.2	598.8	393.8	286.4	232.8	201.0	181.2	140.3	123.4
OPzV2-770	1136	768.4	505.3	367.6	298.7	258.0	232.5	180.0	158.3
OPzV2-800	1180	798.4	525.0	381.9	310.3	268.0	241.6	187.0	164.5
OPzV2-1000	1475	998.0	656.3	477.4	387.9	335.0	302.0	233.8	205.6
OPzV2-1200	1770	1198	787.5	572.9	465.5	402.0	362.4	280.5	246.8
OPzV2-1500	2213	1497	984.4	716.1	581.9	502.5	453.0	350.7	308.5
OPzV2-2000	2951	1996	1313	954.8	775.9	670.0	604.0	467.5	411.3
OPzV2-2500	3688	2495	1641	1193	969.8	837.5	755.0	584.4	514.1
OPzV2-3000	4426	2994	1969	1432	1164	1005	906.0	701.3	616.9

Terminal Discharge Volt at 1.65V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	300.1	208.4	134.9	97.49	78.59	67.60	61.00	47.14	41.32
OPzV2-250	375.1	260.5	168.6	121.9	98.24	84.50	76.25	58.93	51.65
OPzV2-300	450.1	312.7	202.3	146.2	117.9	101.4	91.50	70.71	61.98
OPzV2-350	525.2	364.8	236.0	170.6	137.5	118.3	106.8	82.50	72.31
OPzV2-420	630.2	437.7	283.2	204.7	165.0	142.0	128.1	99.00	86.78
OPzV2-500	750.2	521.1	337.2	243.7	196.5	169.0	152.5	117.9	103.3
OPzV2-600	900.3	625.3	404.6	292.5	235.8	202.8	183.0	141.4	124.0
OPzV2-770	1155	802.5	519.3	375.3	302.6	260.3	234.9	181.5	159.1
OPzV2-800	1200	833.7	539.5	389.9	314.4	270.4	244.0	188.6	165.3
OPzV2-1000	1500	1042	674.4	487.4	393.0	338.0	305.0	235.7	206.6
OPzV2-1200	1801	1251	809.2	584.9	471.5	405.6	366.0	282.9	247.9
OPzV2-1500	2251	1563	1012	731.1	589.4	507.0	457.5	353.6	309.9
OPzV2-2000	3001	2084	1349	974.9	785.9	676.0	610.0	471.4	413.2
OPzV2-2500	3751	2605	1686	1219	982.4	845.0	762.5	589.3	516.5
OPzV2-3000	4501	3127	2023	1462	1179	1014	915.0	707.1	619.8

Terminal Discharge Volt at 1.60V per cell @ 25°C

Model No.	30'	1h	2h	3h	4h	5h	6h	8h	10h
OPzV2-200	303.7	214.9	138.1	100.7	80.60	68.20	61.40	47.34	41.52
OPzV2-250	379.6	268.6	172.6	125.9	100.8	85.25	76.75	59.17	51.90
OPzV2-300	455.6	322.3	207.1	151.1	120.9	102.3	92.10	71.00	62.27
OPzV2-350	531.5	376.0	241.7	176.2	141.1	119.4	107.5	82.84	72.65
OPzV2-420	637.8	451.2	290.0	211.5	169.3	143.2	128.9	99.41	87.18
OPzV2-500	759.3	537.2	345.2	251.8	201.5	170.5	153.5	118.3	103.8
OPzV2-600	911.1	644.6	414.3	302.1	241.8	204.6	184.2	142.0	124.5
OPzV2-770	1169	827.2	531.6	387.7	310.3	262.6	236.4	182.2	159.8
OPzV2-800	1215	859.5	552.3	402.8	322.4	272.8	245.6	189.3	166.1
OPzV2-1000	1519	1074	690.4	503.5	403.0	341.0	307.0	236.7	207.6
OPzV2-1200	1822	1289	828.5	604.2	483.6	409.2	368.4	284.0	249.1
OPzV2-1500	2278	1612	1036	755.3	604.5	511.5	460.5	355.0	311.4
OPzV2-2000	3037	2149	1381	1007	806.0	682.0	614.0	473.4	415.2
OPzV2-2500	3796	2686	1726	1259	1008	852.5	767.5	591.7	519.0
OPzV2-3000	4556	3223	2071	1511	1209	1023	921.0	710.0	622.7

3. Technical Data for Solar Power/Wind Applications

3.1 Technical Manual in Solar Power Applications

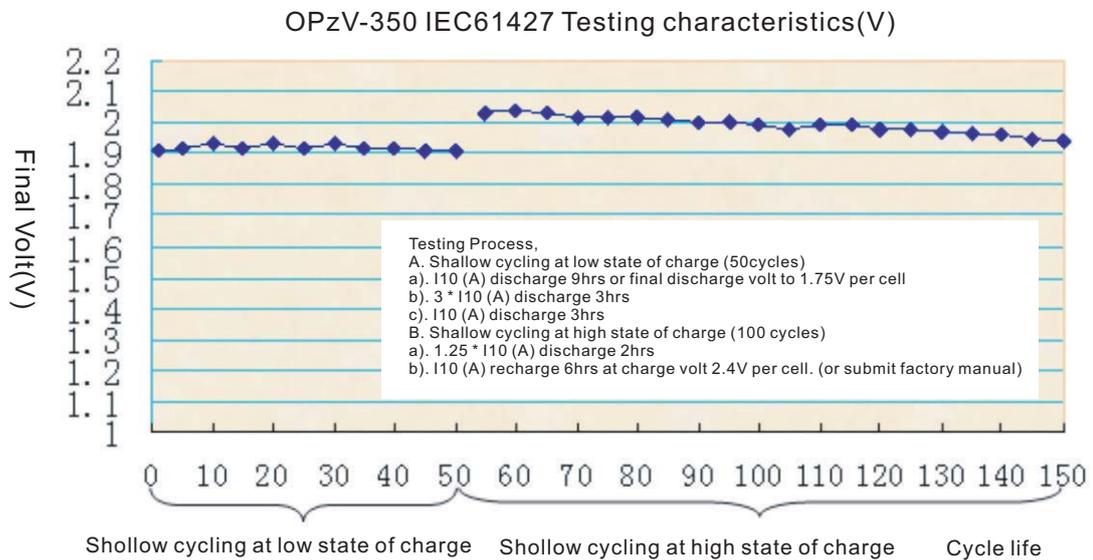
- Max. Charge Current: $\leq 0.2 C_{10} A$
- Max. Charge Voltage: $\leq 2.45V$ per Cell
- Equalize and Cycle use Voltage: $2.35V \sim 2.40V$ per Cell
- Float charging Voltage: $2.25V \sim 2.27V$ per Cell
- Temperature Compensation Coefficient:
 - 3mV per °C for float charge
 - 4mV per °C for equalize charge



3.2 Capacity at Different Hours rate @ 25°C (AH)

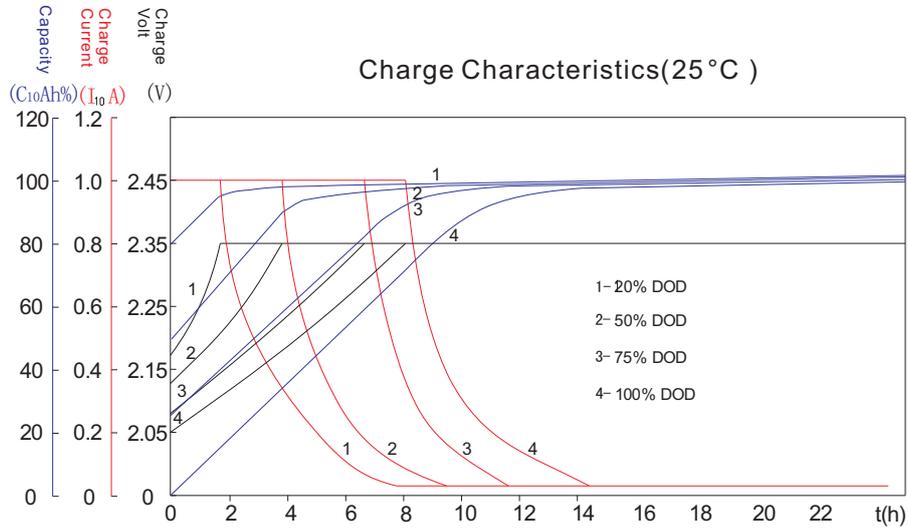
Model No.	C ₂₄ (Ah)	C ₄₈ (Ah)	C ₇₂ (Ah)	C ₁₀₀ (Ah)	C ₁₂₀ (Ah)	C ₂₄₀ (Ah)
	U _f = 1.85V					
OPzV2-200	225	250	255	257	262	266
OPzV2-250	281	312	315	324	328	334
OPzV2-300	337	375	378	385	392	399
OPzV2-350	393	437	440	448	457	465
OPzV2-420	472	525	530	540	550	559
OPzV2-500	552	613	615	625	642	653
OPzV2-600	674	750	755	768	785	799
OPzV2-770	850	951	956	970	987	1006
OPzV2-800	890	1000	1006	1020	1037	1055
OPzV2-1000	1113	1250	1258	1275	1296	1318
OPzV2-1200	1333	1500	1510	1530	1556	1582
OPzV2-1500	1639	1830	1845	1870	1908	1941
OPzV2-2000	2185	2440	2460	2490	2545	2588
OPzV2-2500	2732	3050	3080	3130	3181	3235
OPzV2-3000	3180	3279	3690	3750	3816	3881

3.3 Discharge Voltage Curve at PSOC (IEC61427 Standard)

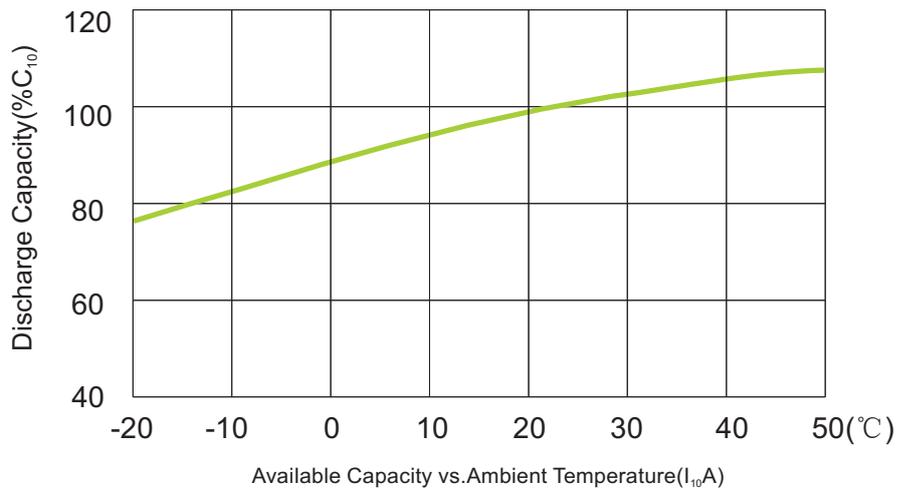


10. Battery Diagrams

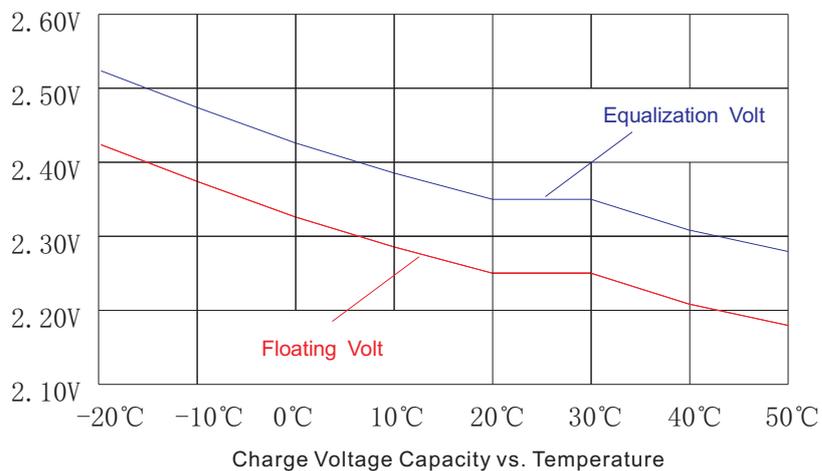
1. Charge Characteristics



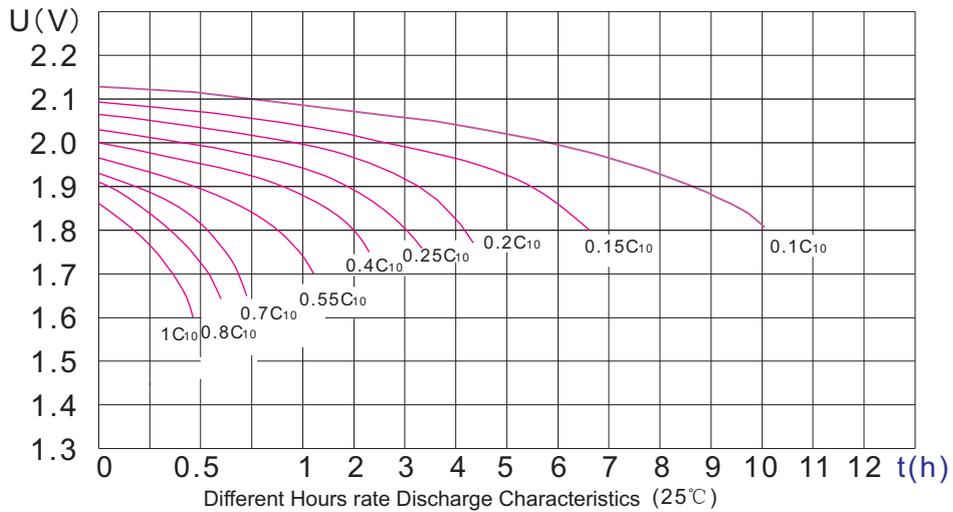
2. Available Capacity vs. Ambient Temperature



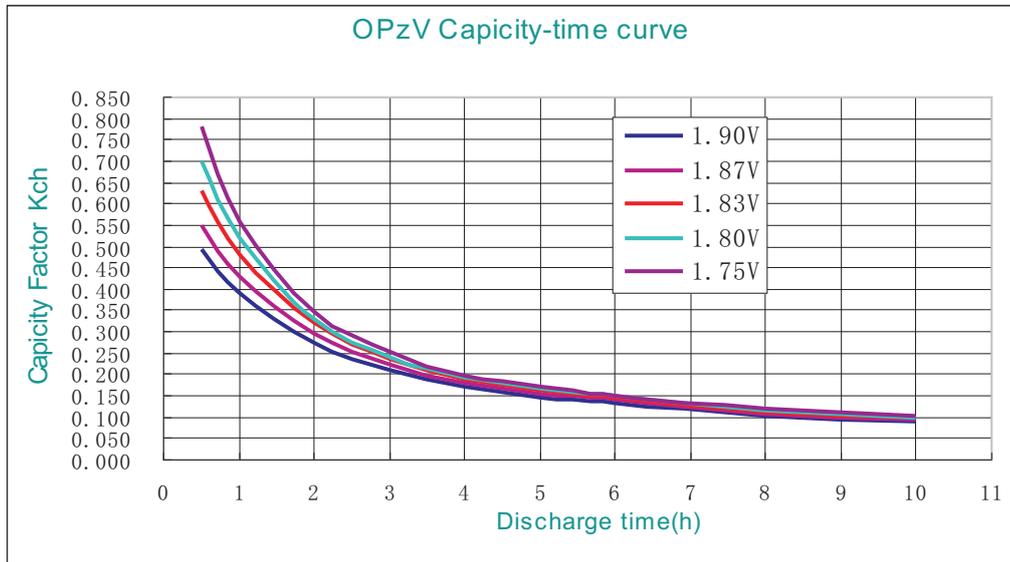
3. Charge Voltage Capacity vs. Temperature



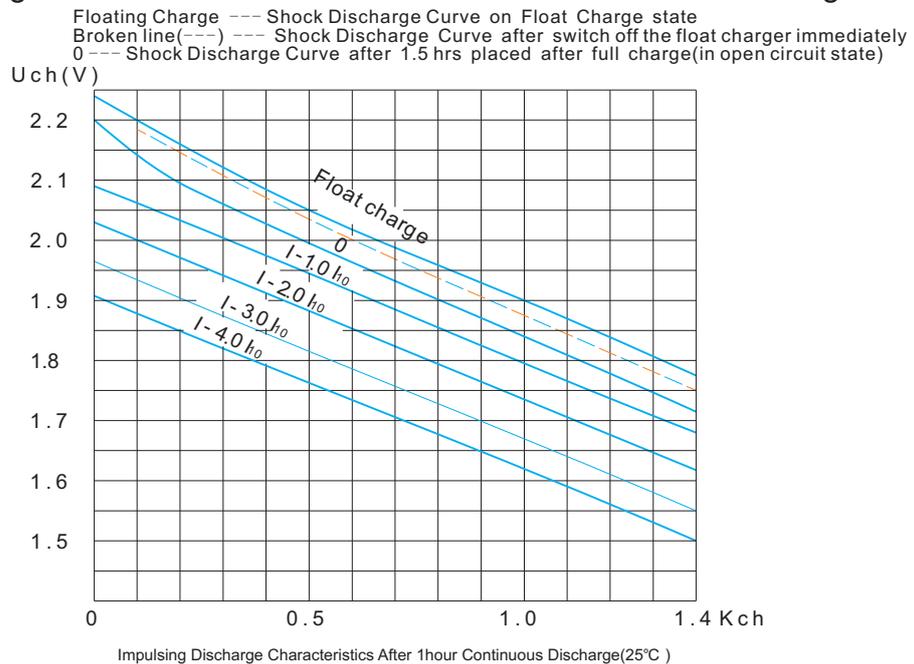
4. Discharge Characteristics



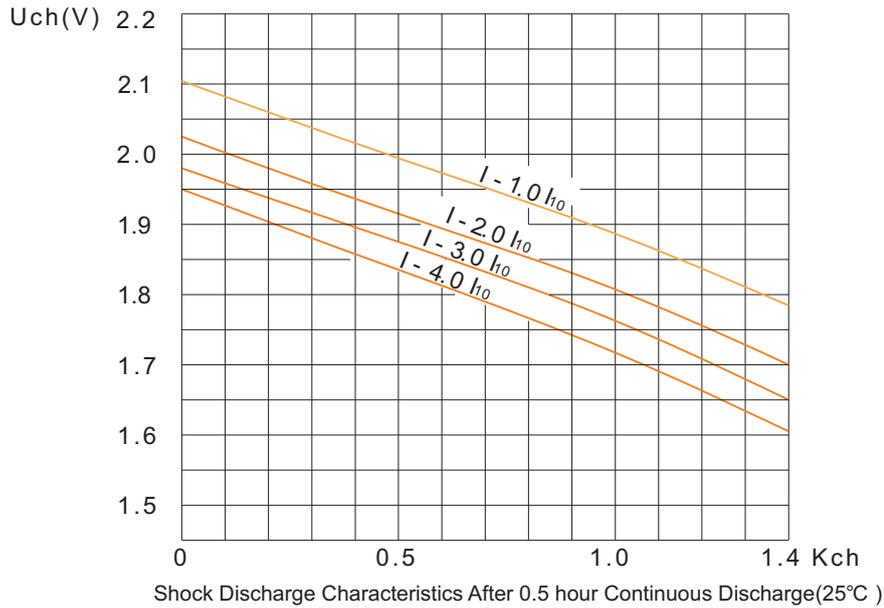
5. Capacity Conversion Factor



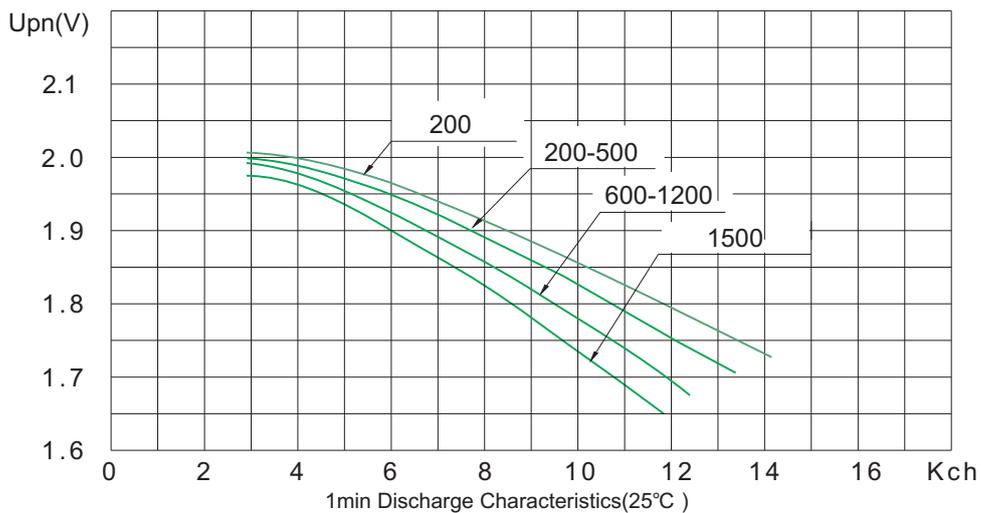
6. Shock Discharge Characteristics After 1hour Continuous Discharge



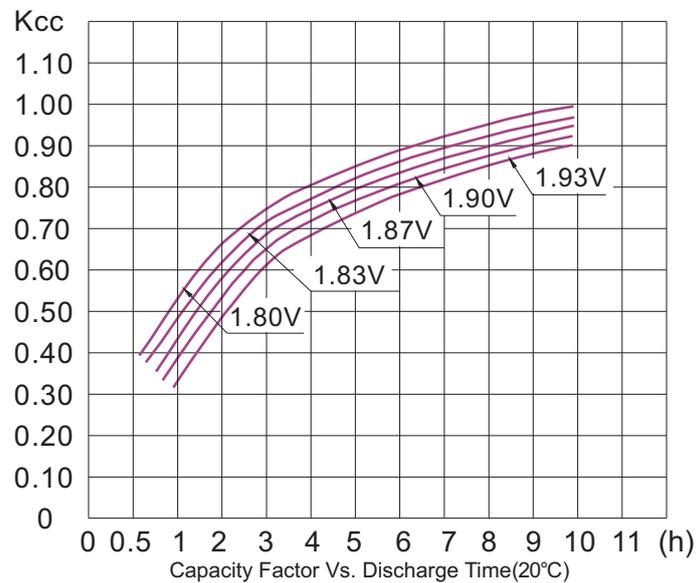
7.Shock Discharge Characteristics After 0.5 hour Continuous Discharge



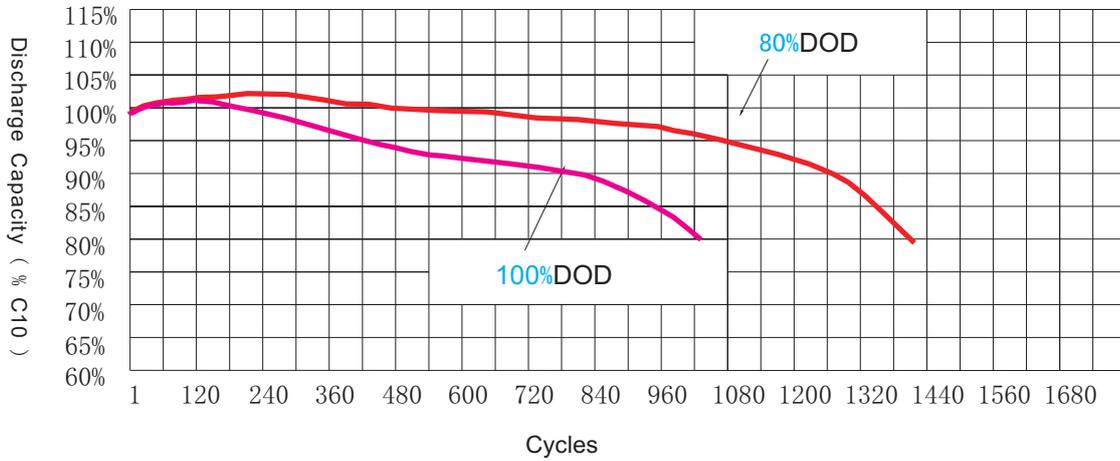
8.1min Discharge Characteristics



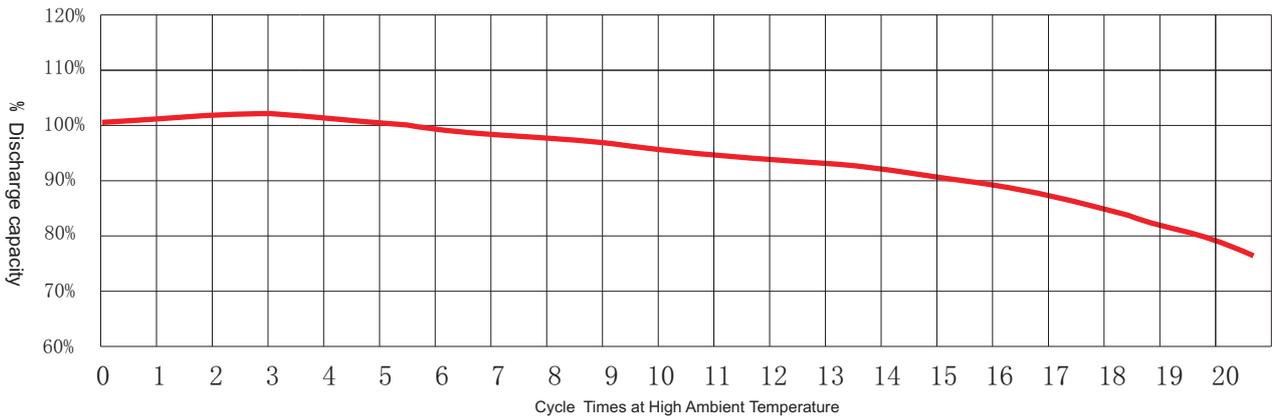
9.Capacity Factor Vs. Discharge Time



10. Cycle Life Characteristics

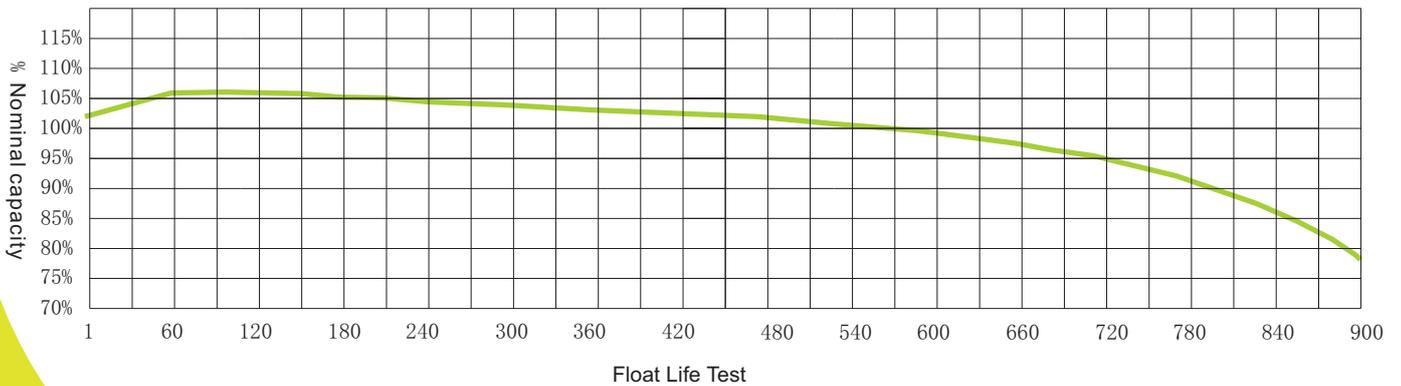


11. High Temperature Accelerated Life Test at 60°C

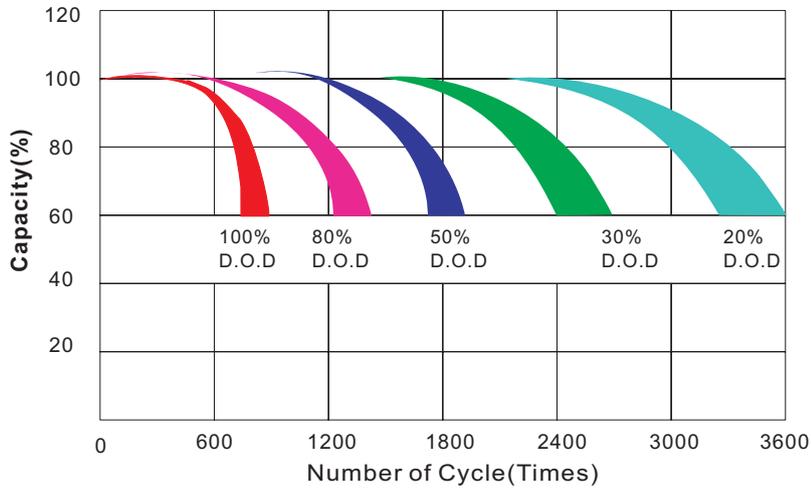


Test Procedure: Under ambient temperature $60 \pm 2^\circ\text{C}$, charge 6pcs * OPzV2-500(in series) battery bank with 13.5V(2.25V per cell)for 30days and then test C5 capacity in room temperature, repeat the cyclic testing until battery available capacity less 80% of marked capacity. One cycle(30 days) testing under ambient temperature $60 \pm 2^\circ\text{C}$ as one year service life at ambient temperature 25°C .

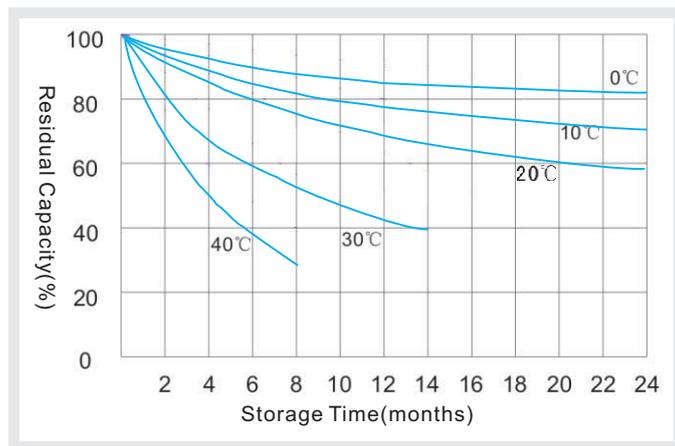
12. Float Life Test (IEC60896-21/22 Standard)



13.Cyclic Life Vs. Depth of Discharge (%DOD)



14.Self-discharge Characteristics



15.Cut-off Voltage vs Discharge Current

To maximize OPzV battery stable service life and avoid over-discharge occurred, at different discharge current with recommended final voltage as following,

Discharge Current(A)	Final Discharge Volt
Discharge Current(A) ≤ 0.1I ₁₀	1.90
0.1I ₁₀ < Discharge Current(A) ≤ I ₁₀	1.85
I ₁₀ < Discharge Current(A) ≤ 4I ₁₀	1.80
4I ₁₀ < Discharge Current(A) ≤ 6I ₁₀	1.75
6I ₁₀ < Discharge Current(A) ≤ 10I ₁₀	1.70
Discharge Current(A) > 15I ₁₀	Not Recommended

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