圣阳电源
SACRED SUN

VALVE-REGULATED SEALED LEAD ACID BATTERY

SPG Series

SACRED SUN

Technical Manual

Contents

Chapter I: Product Introduction

Product Characteristics

Advantages

- Design life: 12 years (25℃)
- EUROBAT Classification: Long life
- High Power and High Energy Density
- Maximum charge efficiency
- High gas recombination efficiency
- Low self-discharge rate
- Easy handling
- Easy installation: vertical or horizontal

Design features

Positive plates	Flat pasted plate with lead-calcium-tin grid alloy
Negative plates	Flat pasted plate with lead-calcium grid alloy
Separators	Microporous AGM separator
Container & Lid	High-strength ABS (option: available in Flame Retardant UL94 V0 version)
Electrolyte	Absorbed sulfuric acid
Terminal posts	High-conductivity terminals with threaded inserts
Posts sealing	Double sealing structure
Vents	High-efficiency low pressure venting system

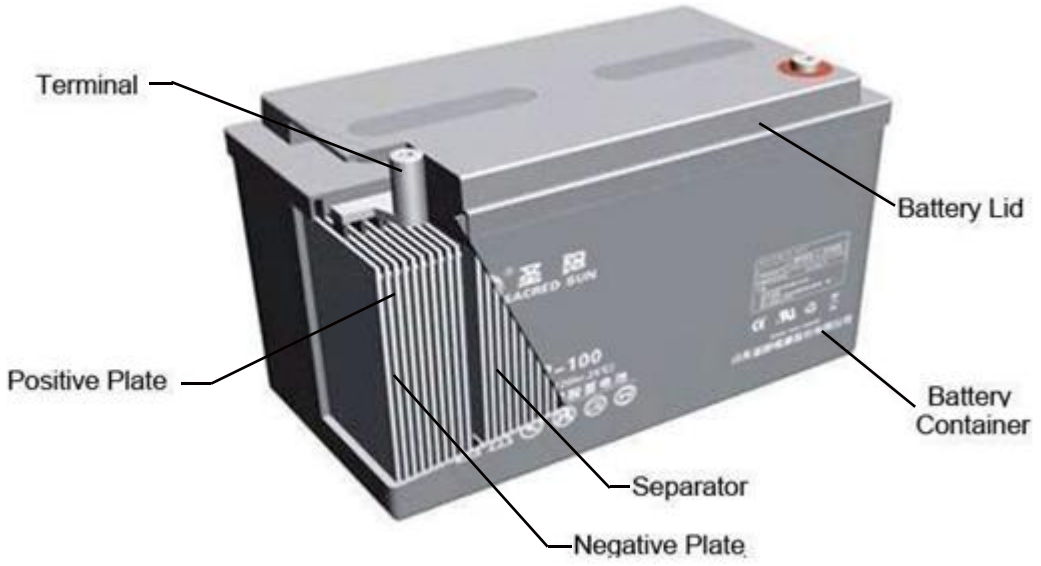
Main Applications

- UPS units
- Data Center
- Generators starting
- EPS unit

Standards

- IEC60896-21/22: 2004
- JIS C8702-1/2:2009
- Eurobat Guide
- Installation compliant with EN50272-2

Battery Construction



General Specifications

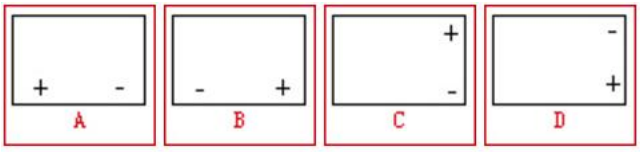
SPG series

- Table 1-1 SPG series battery general specifications

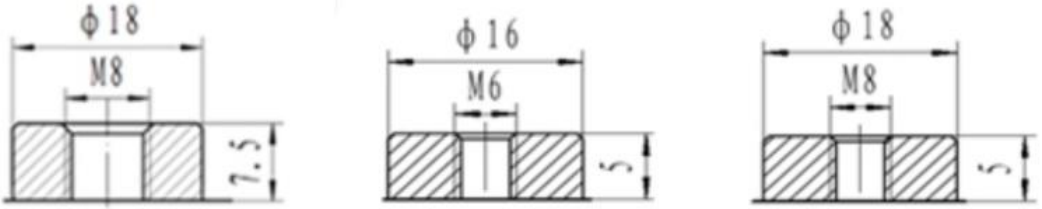
Battery Model	Rated Voltage (V)	Rated Capacity (Ah,25℃) C_{10} 1.80V/cell	W/pc 15 min at 1.67V /cell	Dimensions (mm) Length	Width	Heigth	Total Height	Weight (kg)	Short Circuit Current (A)	Internal Resistance (mΩ,25℃)	Terminal Type	Terminal Layout
SPG12-175W	12	42	175	196	165	165	170	13.9	1600	7.50	M6×Φ16	B
SPG12-215W	12	55	215	228	138	209	214	17.2	1850	6.40	M6×Φ16	A
SPG12-255W	12	70	255	261	171	209	217	22.5	2050	5.80	M6×Φ16	A
SPG12-320W	12	75	320	261	171	209	217	25.5	2650	4.45	M6×Φ16	A
SPG12-300W	12	80	300	350	167	179.5	179.5	24.6	2400	5.00	M6×Φ16	A
SPG12-340W	12	90	340	306	171	209	217	27.4	2450	4.90	M6×Φ16	A
SPG12-390W	12	100	390	330	174	217	226	31.6	3150	3.80	M8×Φ18	A
SPG12-440W	12	115	440	375	174	219	227	36.2	3200	3.70	M8×Φ18	A
SPG12-490W	12	135	490	345	172	275	280	42.5	3300	3.60	M8×Φ18	A
SPG12-500W	12	140	500	483	171	219	227	43.0	3750	3.20	M8×Φ18	A
SPG12-570W	12	145	570	483	171	219	227	45.6	4350	2.75	M8×Φ18	A
SPG12-600W	12	165	600	497	203	228	237	55.0	4300	2.70	M8×Φ18	D
SPG12-660W	12	180	660	497	203	228	237	58.0	4800	2.47	M8×Φ18	D
SPG12-720W	12	200	720	522	234	218	225	63.5	4900	2.45	M8×Φ18	C
SPG12-770W	12	210	770	522	234	218	225	66.3	5700	2.10	M8×Φ18	C
SPG12-800W	12	230	800	534	271	225	233	75.6	5800	2.30	M8×Φ18	C
SPG12-870W	12	250	870	534	271	225	233	77.9	6100	1.95	M8×Φ18	C

Terminals

Terminal Layout



Terminal Type



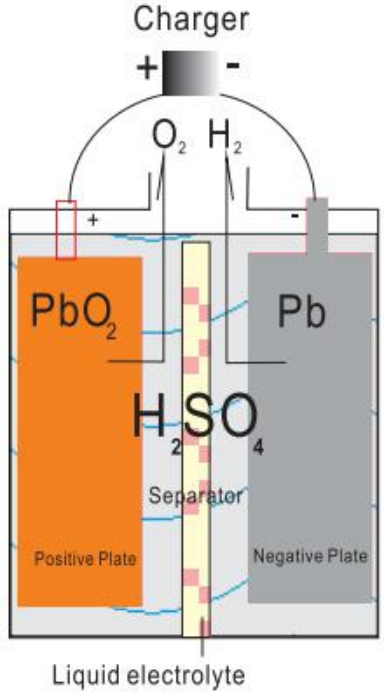
VRLA Technology

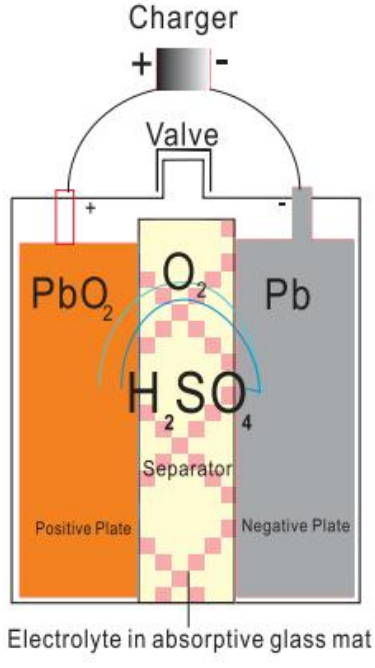
The electrochemical reaction of batteries in charge and discharge process is as follows:

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

In the final stage of charge process, active substance in positive plate is fully transformed to lead dioxide, but negative plate has not reached fully charged stage, the process of active substance in negative plate transforming to spongy lead is not finished, oxygen gas generated in positive plate reaches the negative plate through separator pores and then reacts with active substance in negative plate, resulting depolarized state in negative plate, and restraining the generation of hydrogen.

Principle of the oxygen reduction cycle is as follows:

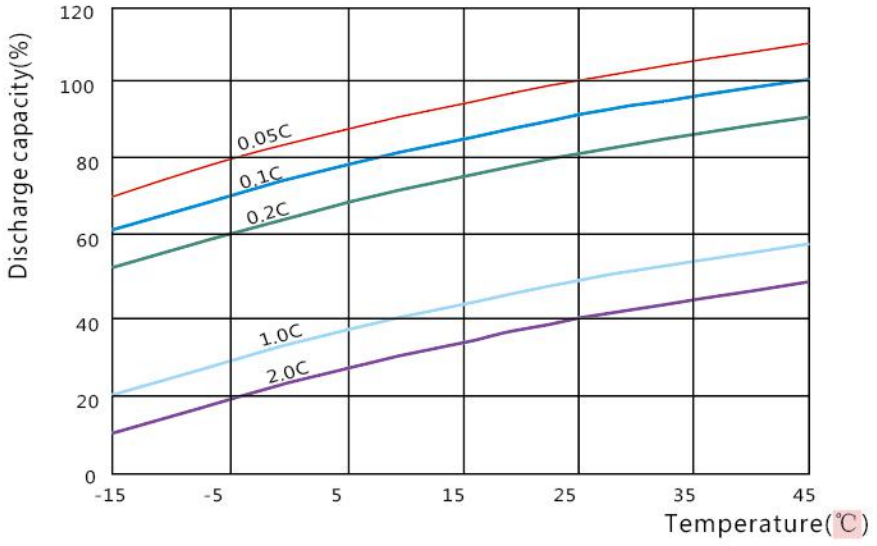




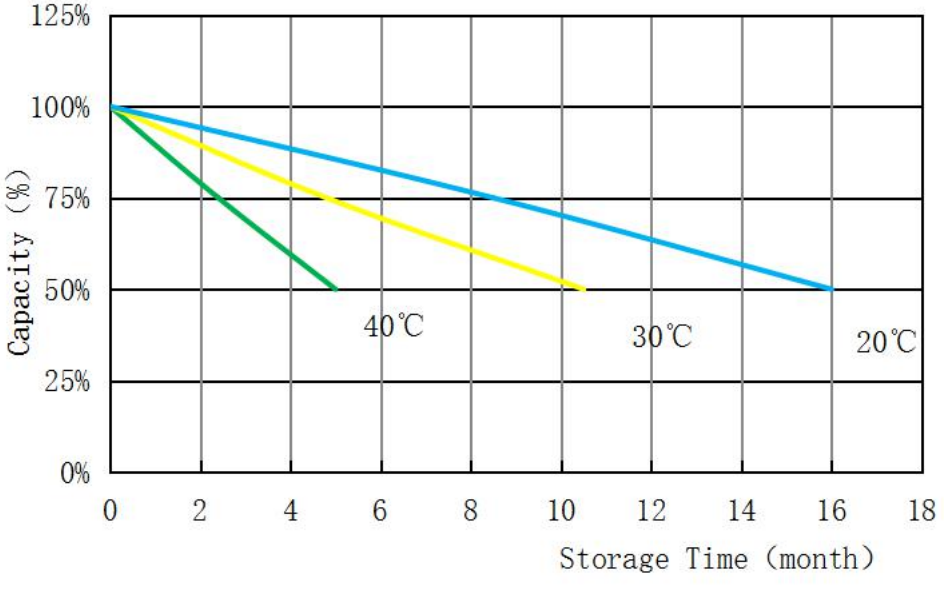
Chapter II: Electrical Characteristics

Discharge Curve

- All series common curves

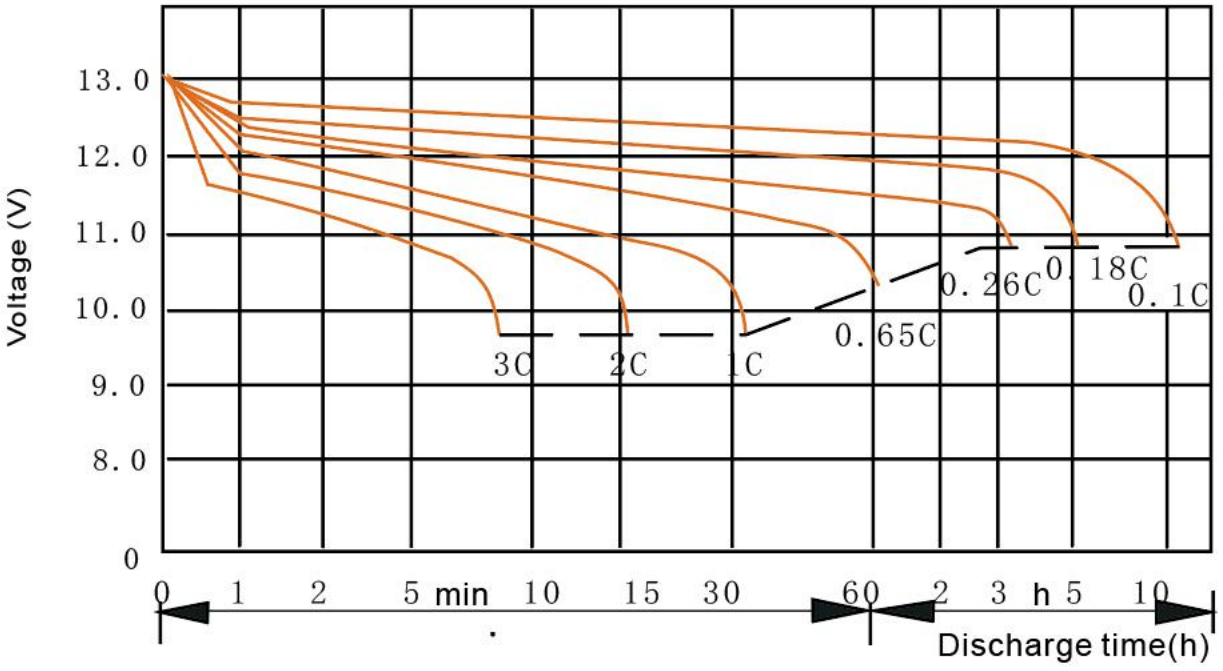


- Figure 2-2 Floating service life and storage time curve



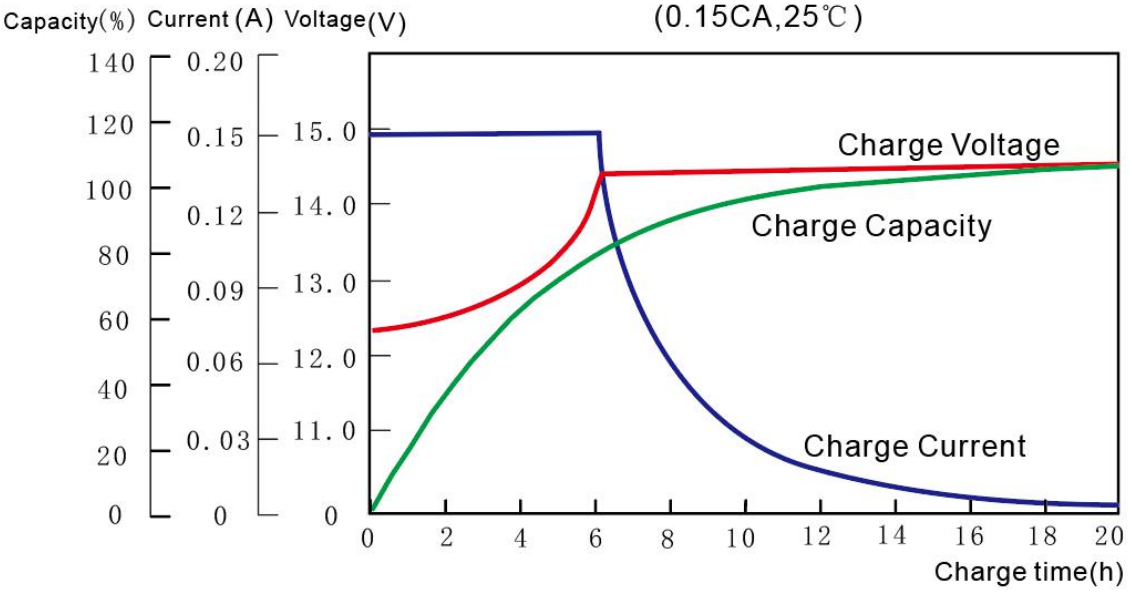
All series characteristic curves

- Figure 2-3 Discharge characteristic curve under different discharge rates (25 ℃)

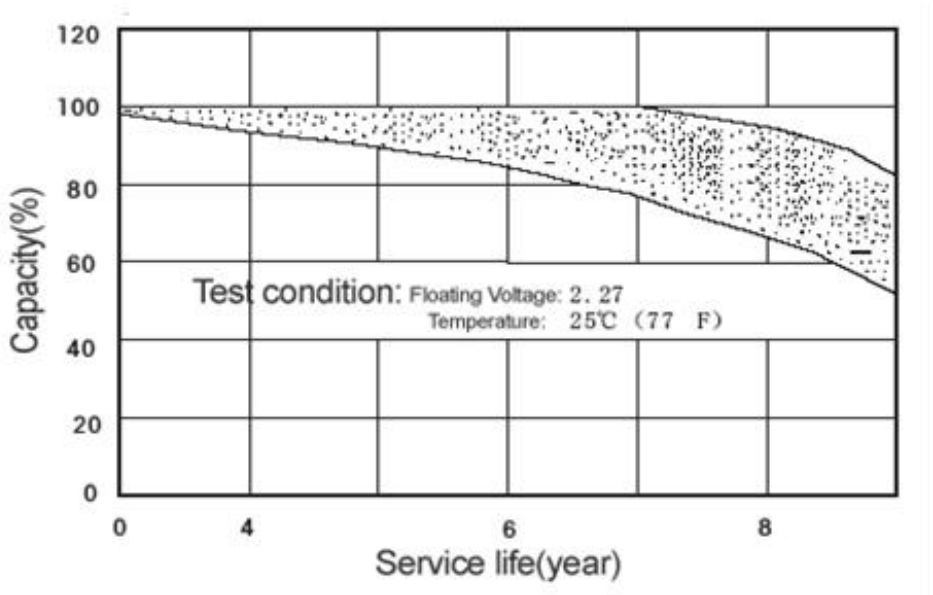


Charge Curve

- Figure 2-4 Charge characteristic curve



- Figure 2-5 Floating charge service life characteristic curve



Performance Data

Constant current discharge data

Table 2-1 SPG Series Battery Constant Current Discharge Data Sheet

Constant Current Discharge Data Sheet(25℃)-------Amperes(A)																
Battery model	End Voltage (V/cell)	Discharge Time														
		5min	10min	15min	20min	25min	30min	45min	1h	1.5h	2h	3h	4h	5h	6h	10h
SPG12-175W	1.60	169	122	98.4	77.9	66.5	57.2	40.7	32.7	23.2	18.2	12.8	10.1	8.31	7.11	4.58
	1.65	158	115	94.0	73.9	63.1	54.2	38.7	31.3	22.3	17.4	12.3	9.73	7.97	6.97	4.49
	1.67	153	111	91.6	71.9	61.6	53.1	37.8	30.4	21.9	17.2	12.0	9.53	7.81	6.76	4.42
	1.70	149	108	88.8	69.7	59.8	51.7	36.7	29.3	21.4	16.8	11.8	9.29	7.62	6.63	4.33
	1.75	138	102	83.7	65.8	56.5	49.0	35.1	28.2	20.7	16.3	11.4	8.97	7.35	6.37	4.28
	1.80	133	97.9	80.7	63.7	54.5	47.0	33.9	26.9	19.7	15.7	10.9	8.67	7.15	6.20	4.20
SPG12-215W	1.60	207	168	123	101	84.0	74.3	51.9	40.6	27.7	21.9	16.4	12.9	11.0	9.48	6.12
	1.65	195	160	118	95.7	80.1	71.2	50.3	38.5	26.5	21.0	15.9	12.6	10.7	9.22	5.95
	1.67	188	155	114	93.7	78.3	69.5	48.3	37.6	25.9	20.6	15.6	12.4	10.6	9.11	5.88
	1.70	183	150	111	91.3	76.2	67.5	47.3	36.6	25.3	20.2	15.3	12.2	10.4	8.99	5.80
	1.75	170	141	105	87.1	72.4	63.8	46.3	35.2	24.1	19.3	14.8	11.8	10.1	8.74	5.64
	1.80	165	130	100	83.0	68.7	60.2	43.8	33.0	23.0	18.5	14.3	11.3	9.68	8.52	5.50
SPG12-255W	1.60	266	200	160	133	113	96.6	67.3	53.7	36.7	29.0	20.8	16.1	13.5	11.5	7.70
	1.65	245	190	154	127	108	93.1	65.6	52.0	35.6	28.2	20.2	15.6	13.1	11.3	7.49
	1.67	235	182	147	122	104	89.6	63.3	50.5	35.0	27.8	19.9	15.4	12.9	11.2	7.42
	1.70	221	172	138	116	100	86.1	61.1	48.5	34.3	27.3	19.5	15.2	12.7	11.0	7.28
	1.75	210	161	128	107	92.4	80.5	57.7	46.7	33.3	26.5	19.0	14.8	12.4	10.7	7.14
	1.80	202	148	118	101	87.4	76.3	53.4	44.5	32.1	25.6	18.4	14.5	12.1	10.5	7.00
SPG12-320W	1.60	285	214	171	143	122	104	72.1	57.6	39.3	31.1	22.3	17.2	14.5	12.4	8.54
	1.65	263	203	165	136	117	100	70.3	55.8	38.1	30.2	21.6	16.8	14.0	12.1	8.30
	1.67	252	195	158	131	113	96.0	67.8	54.1	37.5	29.7	21.3	16.5	13.8	11.9	8.23
	1.70	236	184	148	124	107	92.3	65.5	52.0	36.8	29.2	20.9	16.3	13.6	11.7	8.07
	1.75	225	173	137	115	99.0	86.3	61.9	50.1	35.7	28.4	20.3	15.9	13.3	11.5	7.92
	1.80	216	159	126	109	94.0	81.8	57.3	47.6	34.4	27.4	19.7	15.5	13.0	11.3	7.50
SPG12-300W	1.60	276	207	166	138	118	100	69.9	58.5	41.9	33.8	23.8	18.3	15.4	13.2	8.80
	1.65	255	197	160	132	113	96.8	68.2	56.6	40.7	32.9	23.0	17.9	14.9	12.9	8.56
	1.67	244	189	153	127	109	93.1	65.8	55.0	40.0	32.3	22.7	17.6	14.8	12.7	8.48
	1.70	229	178	143	120	104	89.5	63.5	52.8	39.2	31.8	22.3	17.3	14.5	12.5	8.32
	1.75	218	167	133	111	96	83.7	60.0	50.9	38.1	30.9	21.7	17.0	14.2	12.3	8.16
	1.80	210	154	122	105	91	79.3	55.5	48.4	36.6	29.8	21.0	16.5	13.9	12.0	8.00

- Table 2-1 SPG Series Battery Constant Current Discharge Data Sheet

Constant Current Discharge Data Sheet(25℃)-------Amperes(A)																
Battery model	End Voltage (V/cell)	Discharge Time														
		5min	10min	15min	20min	25min	30min	45min	1h	1.5h	2h	3h	4h	5h	6h	10h
SPG12-340W	1.60	323	249	198	165	140	120	83.3	67.2	45.8	36.3	26.2	20.1	16.9	14.4	9.90
	1.65	298	237	191	157	135	115	81.2	65.0	44.5	35.3	25.4	19.6	16.3	14.1	9.63
	1.67	286	228	182	152	130	111	78.4	63.1	43.7	34.7	25.1	19.3	16.1	13.9	9.54
	1.70	268	214	171	143	123	107	75.7	60.6	42.9	34.1	24.6	19.0	15.9	13.7	9.36
	1.75	255	201	159	133	114	100	71.5	58.4	41.7	33.1	23.9	18.5	15.5	13.4	9.18
	1.80	245	186	146	126	108	94.5	66.2	55.6	40.1	32.0	23.2	18.1	15.2	13.2	9.00
SPG12-390W	1.60	380	285	228	190	162	138	96.2	76.8	52.4	41.5	29.7	22.9	19.3	16.5	11.0
	1.65	350	271	220	181	155	133	93.7	74.3	50.8	40.3	28.8	22.3	18.7	16.1	10.7
	1.67	336	260	210	175	150	128	90.4	72.1	50.0	39.6	28.4	22.1	18.4	15.9	10.6
	1.70	315	245	197	165	142	123	87.3	69.3	49.0	38.9	27.9	21.7	18.1	15.7	10.4
	1.75	300	230	183	153	132	115	82.5	66.8	47.6	37.9	27.1	21.2	17.7	15.4	10.2
	1.80	288	212	168	145	125	109	76.3	63.5	45.8	36.6	26.3	20.7	17.3	15.0	10.0
SPG12-440W	1.60	426	323	266	222	189	161	112	89.5	61.1	48.4	34.7	26.8	22.5	19.2	12.8
	1.65	392	307	257	212	181	155	109	86.7	59.3	47.0	33.6	26.1	21.8	18.8	12.5
	1.67	376	294	245	204	175	152	105	84.2	58.3	46.3	33.1	25.7	21.5	18.6	12.4
	1.70	353	277	230	193	166	144	102	80.9	57.2	45.4	32.6	25.3	21.2	18.3	12.1
	1.75	336	260	214	179	154	134	96.2	77.9	55.5	44.2	31.6	24.7	20.7	17.9	11.9
	1.80	323	240	196	169	146	130	89.1	74.1	53.4	42.7	30.7	24.1	20.2	17.5	11.5
SPG12-490W	1.60	440	340	279	226	192	166	116	94.1	73.5	56.7	39.5	30.3	24.8	21.1	14.1
	1.65	416	327	269	219	186	161	113	91.2	71.8	55.6	38.3	29.4	24.4	20.9	14.0
	1.67	397	316	260	213	180	156	110	89.4	70.4	54.5	37.6	28.5	24.1	20.6	13.9
	1.70	387	306	251	207	174	152	108	87.6	69.2	53.7	36.9	28.3	23.7	20.5	13.8
	1.75	366	288	241	196	166	146	103	85.0	67.1	52.3	35.8	27.7	23.5	20.2	13.6
	1.80	341	268	226	185	158	138	98.5	81.5	64.6	50.6	34.3	26.9	22.8	19.9	13.5
SPG12-500W	1.60	453	347	285	231	195	170	118	96.0	75.0	57.9	40.3	30.9	25.3	21.6	14.5
	1.65	428	334	275	223	189	164	115	93.0	73.3	56.7	39.1	30.0	24.9	21.3	14.4
	1.67	409	323	266	217	184	160	112	91.2	71.9	55.7	38.4	29.1	24.6	21.0	14.3
	1.70	399	312	256	211	178	156	110	89.4	70.6	54.8	37.6	28.9	24.1	20.9	14.2
	1.75	378	294	246	200	169	149	105	86.7	68.4	53.3	36.5	28.3	24.0	20.6	14.1
	1.80	351	274	231	189	161	141	101	83.2	65.9	51.6	35.0	27.4	23.3	20.3	14.0

Table 2-1 SPG Series Battery Constant Current Discharge Data Sheet

Constant Current Discharge Data Sheet(25℃)-------Amperes(A)																
Battery model	End Voltage (V/cell)	Discharge Time														
		5min	10min	15min	20min	25min	30min	45min	1h	1.5h	2h	3h	4h	5h	6h	10h
SPG12-570W	1.60	510	390	327	265	224	195	137	108	84.4	65.1	45.4	34.8	28.4	24.3	15.1
	1.65	482	376	315	256	217	188	133	105	82.5	63.8	44.0	33.7	28.0	24.0	15.0
	1.67	460	363	305	249	211	183	130	103	80.8	62.6	43.2	32.8	27.6	23.7	14.9
	1.70	449	351	294	242	204	179	127	101	79.5	61.7	42.3	32.5	27.2	23.5	14.8
	1.75	425	330	282	230	194	170	122	97.5	77.0	60.0	41.1	31.9	27.0	23.2	14.6
	1.80	395	308	265	217	185	162	117	93.6	74.2	58.1	39.4	30.8	26.2	22.8	14.5
SPG12-600W	1.60	533	434	363	295	249	212	152	120	93.8	72.4	50.4	38.6	31.6	27.0	17.0
	1.65	503	417	350	285	241	198	148	116	91.6	70.9	48.9	37.5	31.1	26.6	16.9
	1.67	480	404	339	277	235	193	145	114	89.8	69.6	48.0	36.4	30.7	26.3	16.8
	1.70	469	390	327	269	227	188	141	112	88.3	68.6	47.0	36.1	30.2	26.1	16.7
	1.75	444	367	313	255	216	178	136	108	85.5	66.7	45.6	35.4	30.0	25.8	16.6
	1.80	413	342	294	238	206	165	129	104	82.4	64.5	43.8	34.2	29.1	25.4	16.5
SPG12-660W	1.60	586	477	400	324	274	238	168	132	103	79.6	55.4	42.5	34.7	29.7	18.4
	1.65	554	459	385	313	266	230	163	128	101	78.0	53.8	41.2	34.2	29.3	18.3
	1.67	528	444	373	304	258	224	159	125	98.8	76.5	52.7	40.0	33.8	28.9	18.2
	1.70	516	429	359	296	249	218	156	123	97.1	75.4	51.7	39.7	33.2	28.8	18.1
	1.75	488	404	345	281	237	208	149	119	94.1	73.3	50.2	38.9	33.0	28.4	17.8
	1.80	454	376	324	265	226	198	142	114	90.7	71.0	48.1	37.7	32.1	27.9	18.0
SPG12-720W	1.60	652	499	423	343	290	252	177	140	109	84.2	58.6	44.8	36.7	31.4	20.8
	1.65	617	480	407	331	281	243	172	135	107	82.5	56.9	43.5	36.2	31.0	20.7
	1.67	588	465	394	322	273	237	168	133	104	81.0	55.8	42.2	35.7	30.6	20.6
	1.70	575	449	380	313	264	231	165	130	103	79.8	54.7	41.9	35.1	30.4	20.4
	1.75	544	423	365	297	251	220	158	126	100	77.6	53.1	41.1	34.9	30.0	20.2
	1.80	505	394	343	280	239	209	151	121	95.9	75.1	50.9	39.8	33.9	29.5	20.0
SPG12-770W	1.60	700	564	472	383	324	281	198	156	122	94.1	65.5	50.2	41.0	35.1	21.8
	1.65	661	542	455	370	314	272	193	151	119	92.1	63.5	48.7	40.4	34.6	21.7
	1.67	631	525	441	360	305	265	188	148	117	90.4	62.3	47.3	39.9	34.2	21.5
	1.70	616	507	425	349	294	258	184	145	115	89.1	61.1	46.9	39.2	34.0	21.4
	1.75	583	477	407	332	281	246	176	141	111	86.7	59.3	46.0	39.0	33.5	21.1
	1.80	542	445	383	313	267	233	168	135	107	83.9	56.9	44.5	37.9	33.0	21.0

- Table 2-1 SPG Series Battery Constant Current Discharge Data Sheet

Constant Current Discharge Data Sheet(25℃)-------Amperes(A)																
Battery model	End Voltage (V/cell)	Discharge Time														
		5min	10min	15min	20min	25min	30min	45min	1h	1.5h	2h	3h	4h	5h	6h	10h
SPG12-800W	1.60	754	583	488	396	335	285	205	163	127	98.3	68.4	52.5	42.9	36.6	23.9
	1.65	712	561	470	383	324	275	199	158	124	96.2	66.4	50.9	42.2	36.1	23.8
	1.67	680	542	455	372	316	268	194	155	122	94.5	65.1	49.4	41.7	35.7	23.6
	1.70	664	524	439	361	304	261	190	152	120	93.1	63.8	49.0	41.0	35.5	23.5
	1.75	628	493	421	343	290	248	182	147	116	90.5	61.9	48.1	40.7	35.0	23.2
	1.80	584	460	396	323	277	236	174	141	112	87.6	59.4	46.5	39.6	34.5	23.0
SPG12-870W	1.60	808	624	523	424	359	312	219	175	136	105	73.3	56.2	45.9	39.2	26.0
	1.65	763	601	504	410	348	301	213	169	133	103	71.1	54.5	45.3	38.7	25.8
	1.67	728	581	488	398	338	293	208	166	131	101	69.8	53.0	44.7	38.3	25.6
	1.70	711	561	470	387	326	286	204	163	128	100	68.4	52.5	43.9	38.0	25.5
	1.75	673	528	451	368	311	273	195	158	124	97.0	66.4	51.5	43.6	37.5	25.1
	1.80	625	493	424	346	296	259	186	151	120	93.9	63.7	49.8	42.4	36.9	25.0

Constant power discharge data

- Table 2-2 SPG Series Battery Constant Power Discharge Data Sheet(W/cell, 25 ℃)

Constant Power Discharge Data Sheet (25℃)-------Watt (W)																
Battery model	End Voltage (V/cell)	Discharge Time														
		5min	10min	15min	20min	25min	30min	45min	1h	1.5h	2h	3h	4h	5h	6h	10h
SPG12-175W	1.60	315	237	183	141	118	103	72.3	62.2	45.7	35.3	26.0	20.9	17.1	14.6	9.63
	1.65	302	229	176	136	113	100	70.1	60.3	44.3	34.1	25.4	20.4	16.7	14.3	9.44
	1.67	298	223	175	134	111	98.2	69.1	59.4	43.7	33.7	25.1	20.3	16.6	14.2	9.36
	1.70	292	217	170	132	110	96.5	68.0	58.5	43.0	33.1	24.7	20.0	16.5	14.1	9.25
	1.75	280	211	165	127	106	93.1	66.0	56.8	41.7	32.1	24.0	19.5	16.0	13.7	9.06
	1.80	269	203	158	123	102	89.8	63.7	55.1	40.4	31.1	23.4	19.0	15.6	13.4	8.86
SPG12-215W	1.60	385	289	226	179	147	132	96.8	78.4	61.3	46.6	33.8	26.5	21.8	18.9	12.4
	1.65	370	282	219	173	142	128	93.4	76.2	59.6	45.2	33.1	26.0	21.3	18.4	12.1
	1.67	362	275	215	170	139	126	92.1	75.2	59.0	44.6	32.4	25.7	21.1	18.3	12.1
	1.70	355	262	209	166	136	124	90.9	74.1	57.9	43.8	31.5	25.4	20.7	18.1	11.9
	1.75	337	250	202	160	132	120	87.9	72.0	55.9	42.5	30.8	24.8	20.2	17.7	11.6
	1.80	320	235	194	155	127	116	85.1	69.8	53.9	41.0	29.6	24.2	19.6	17.4	11.4
SPG12-255W	1.60	435	330	268	221	183	170	124	97.8	74.6	56.9	42.5	33.0	26.9	22.9	15.1
	1.65	424	317	260	215	179	164	121	94.3	72.5	55.2	41.4	32.4	26.1	22.5	15.0
	1.67	405	310	255	211	175	160	118	92.9	70.7	53.9	40.6	31.6	25.5	22.2	14.8
	1.70	388	304	252	205	170	156	117	90.8	69.4	52.9	40.0	31.0	25.1	21.8	14.6
	1.75	375	295	242	197	164	150	113	88.1	67.8	51.8	38.8	30.0	24.6	21.4	14.4
	1.80	365	283	232	191	158	144	109	84.6	65.3	50.1	37.6	29.2	23.9	20.9	14.1

- Table 2-2 SPG Series Battery Constant Power Discharge Data Sheet(W/cell, 25 ℃)

Constant Power Discharge Data Sheet (25℃)-------Watt (W)																
Battery model	End Voltage (V/cell)	Discharge Time														
		5min	10min	15min	20min	25min	30min	45min	1h	1.5h	2h	3h	4h	5h	6h	10h
SPG12-320W	1.60	533	412	335	288	238	217	155	122	93.2	71.1	53.1	41.3	33.6	28.6	18.9
	1.65	519	400	325	279	231	210	151	118	90.7	69.0	51.7	40.4	32.7	28.1	18.7
	1.67	496	392	320	274	226	204	148	116	88.4	67.3	50.7	39.5	31.9	27.7	18.5
	1.70	475	383	314	267	221	198	146	114	86.8	66.1	50.0	38.8	31.4	27.3	18.3
	1.75	460	373	302	257	214	191	142	110	84.7	64.8	48.5	37.6	30.7	26.8	18.0
	1.80	444	358	290	249	206	183	136	106	81.7	62.6	46.9	36.5	29.9	26.1	17.7
SPG12-300W	1.60	520	399	315	274	226	206	149	117	89.5	68.2	51.0	39.7	32.3	27.4	18.1
	1.65	506	388	306	265	219	199	145	113	87.0	66.3	49.7	38.8	31.4	27.0	17.9
	1.67	483	380	300	260	214	194	142	111	84.8	64.6	48.7	37.9	30.6	26.6	17.8
	1.70	463	372	296	254	210	188	140	109	83.3	63.5	48.0	37.3	30.2	26.2	17.5
	1.75	449	361	284	244	203	182	136	106	81.4	62.2	46.5	36.1	29.5	25.7	17.3
	1.80	433	347	273	236	195	174	130	102	78.4	60.1	45.1	35.1	28.7	25.1	16.9
SPG12-340W	1.60	560	424	352	297	245	223	162	128	96.9	73.2	54.7	42.5	34.6	29.5	19.4
	1.65	545	412	345	288	238	216	157	124	94.3	71.1	53.3	41.7	33.7	29.0	19.2
	1.67	521	403	340	282	233	210	154	122	91.9	69.3	52.2	40.7	32.8	28.6	19.1
	1.70	499	395	330	275	228	204	152	119	90.3	68.1	51.5	40.0	32.4	28.1	18.8
	1.75	484	384	318	264	220	197	147	116	88.1	66.7	49.9	38.7	31.7	27.6	18.5
	1.80	466	368	305	256	212	189	141	111	84.9	64.4	48.4	37.6	30.8	26.9	18.2
SPG12-390W	1.60	640	494	410	346	286	260	186	147	112	85.3	63.7	49.6	40.3	34.3	22.6
	1.65	623	480	398	335	277	252	181	141	109	82.8	62.1	48.5	39.2	33.8	22.4
	1.67	595	470	390	329	271	244	177	139	106	80.8	60.8	47.4	38.3	33.3	22.2
	1.70	570	460	385	321	266	238	175	136	104	79.4	60.0	46.6	37.7	32.7	21.9
	1.75	552	447	372	308	256	229	170	132	102	77.7	58.2	45.1	36.9	32.1	21.6
	1.80	533	429	355	298	247	220	163	127	98.0	75.1	56.3	43.8	35.9	31.3	21.2
SPG12-440W	1.60	702	548	464	392	340	303	218	171	132	99.5	74.3	57.8	47.0	40.0	26.4
	1.65	683	532	450	379	330	294	212	165	128	96.6	72.4	56.6	45.7	39.4	26.2
	1.67	653	521	442	372	322	285	207	163	125	94.2	71.0	55.3	44.6	38.8	25.9
	1.70	625	510	431	363	316	278	204	159	123	92.6	70.0	54.3	44.0	38.2	25.6
	1.75	605	495	419	349	305	268	198	154	120	90.7	67.8	52.6	43.0	37.5	25.2
	1.80	585	475	402	337	294	256	190	148	115	87.6	65.7	51.1	41.9	36.6	24.7

- Table 2-2 SPG Series Battery Constant Power Discharge Data Sheet(W/cell, 25 ℃)

Constant Power Discharge Data Sheet (25℃)-------Watt (W)																
Battery model	End Voltage (V/cell)	Discharge Time														
		5min	10min	15min	20min	25min	30min	45min	1h	1.5h	2h	3h	4h	5h	6h	10h
SPG12-490W	1.60	770	642	524	426	367	338	237	199	149	113	77.3	61.5	52.4	45.9	28.8
	1.65	731	615	510	413	360	331	232	193	144	110	75.0	60.5	52.1	45.2	28.4
	1.67	712	592	490	399	353	325	227	189	140	107	73.5	59.6	50.3	44.1	27.8
	1.70	691	570	474	384	340	317	223	186	137	106	71.9	58.9	49.8	43.7	27.4
	1.75	667	546	457	370	329	308	219	180	133	104	70.7	58.2	48.9	42.7	26.9
	1.80	642	520	437	354	317	296	212	173	130	101	69.4	56.8	47.4	41.6	26.1
SPG12-500W	1.60	798	655	535	435	375	340	242	203	152	115	78.9	62.8	53.5	46.9	29.4
	1.65	757	627	520	422	368	333	236	197	147	112	76.6	61.7	52.6	46.1	28.7
	1.67	738	604	500	407	360	327	232	193	142	109	75.0	60.9	51.3	45.0	28.5
	1.70	716	581	489	392	347	319	228	190	140	108	73.4	60.1	50.8	44.6	28.2
	1.75	692	558	467	377	336	310	223	184	136	106	72.1	59.4	49.9	43.6	27.8
	1.80	665	531	446	362	324	297	216	176	132	103	70.8	58.0	48.4	42.5	26.9
SPG12-570W	1.60	898	715	602	479	413	375	269	219	164	124	85.4	67.9	57.9	50.7	31.8
	1.65	852	685	585	465	405	367	263	213	159	121	82.8	66.7	56.9	49.9	31.1
	1.67	830	660	570	449	397	360	258	209	154	118	81.1	65.8	55.5	48.7	30.9
	1.70	805	635	550	432	383	352	253	205	151	117	79.4	65.0	54.9	48.3	30.6
	1.75	778	609	525	416	371	342	248	199	147	114	78.0	64.2	54.0	47.2	30.0
	1.80	748	580	502	399	357	328	241	191	143	111	76.6	62.7	52.3	46.0	29.1
SPG12-600W	1.60	948	768	632	522	450	385	289	236	176	134	91.7	73.0	62.2	54.5	34.2
	1.65	899	736	614	506	441	378	283	229	171	130	89.0	71.7	61.1	53.6	33.4
	1.67	876	710	600	489	432	370	278	225	165	127	87.2	70.7	59.7	52.3	33.2
	1.70	850	682	582	471	417	362	272	220	162	125	85.3	69.8	59.0	51.9	32.8
	1.75	821	654	554	453	404	348	269	214	158	123	83.9	69.0	58.0	50.7	32.3
	1.80	790	623	534	434	389	335	258	205	154	119	82.3	67.4	56.2	49.4	31.3
SPG12-660W	1.60	1043	845	695	574	495	440	318	259	194	147	101	80.3	68.4	59.9	37.6
	1.65	989	810	675	557	486	431	311	252	188	143	97.9	78.9	67.2	59.0	36.7
	1.67	964	780	660	538	476	423	305	247	182	140	95.9	77.8	65.6	57.5	36.5
	1.70	935	750	640	518	459	413	300	242	178	138	93.8	76.8	64.9	57.1	36.1
	1.75	903	720	609	498	444	401	296	235	174	135	92.2	75.9	63.8	55.7	35.5
	1.80	869	685	587	478	428	385	284	225	169	131	90.5	74.1	61.8	54.3	34.4

■ Table 2-2 SPG Series Battery Constant Power Discharge Data Sheet(W/cell, 25 ℃)

Constant Power Discharge Data Sheet (25℃)-------Watt (W)																
Battery model	End Voltage (V/cell)	Discharge Time														
		5min	10min	15min	20min	25min	30min	45min	1h	1.5h	2h	3h	4h	5h	6h	10h
SPG12-720W	1.60	1125	900	753	606	523	464	347	282	211	160	108	85.3	73.1	64.1	41.5
	1.65	1067	862	732	588	513	455	339	275	205	156	105	83.9	71.9	63.0	40.6
	1.67	1039	831	720	568	502	445	333	269	198	152	102	82.7	70.2	61.5	40.3
	1.70	1008	799	699	547	485	436	326	264	194	150	100	81.7	69.4	61.0	39.9
	1.75	974	766	664	526	469	425	320	256	189	147	98.6	80.8	68.2	59.6	39.2
	1.80	937	730	635	513	452	406	310	246	184	143	96.8	79.0	66.1	58.1	37.9
SPG12-770W	1.60	1206	1002	814	679	573	509	370	304	227	180	123	98.1	83.6	71.3	44.1
	1.65	1145	960	790	658	562	499	361	296	220	175	120	96.4	82.2	69.9	43.1
	1.67	1115	925	770	635	551	489	355	290	214	171	117	95.1	80.2	69.1	42.8
	1.70	1081	890	752	612	531	478	348	284	209	168	115	93.9	79.4	67.9	42.4
	1.75	1045	853	725	589	514	464	341	276	204	165	113	92.8	78.0	66.8	41.6
	1.80	1005	813	690	565	495	445	330	264	198	161	111	90.6	75.6	64.9	40.3
SPG12-800W	1.60	1290	1068	858	738	617	548	427	348	260	197	135	108	91.5	80.4	50.5
	1.65	1226	1023	834	716	605	537	418	338	252	193	131	106	90.5	79.2	49.3
	1.67	1194	986	800	691	593	526	410	332	244	188	129	104	87.7	77.2	49.0
	1.70	1158	948	786	666	572	515	402	325	240	185	126	103	86.8	76.6	48.5
	1.75	1119	909	750	641	554	500	396	316	233	182	124	102	85.9	74.8	47.6
	1.80	1076	866	715	614	533	475	385	303	227	176	122	100	83.0	72.9	46.1
SPG12-870W	1.60	1384	1144	933	791	661	599	458	373	279	212	145	115	98.4	86.2	54.1
	1.65	1314	1096	907	767	649	588	448	362	270	206	141	113	96.7	84.8	52.8
	1.67	1280	1056	870	741	635	576	439	355	262	201	138	112	94.4	82.8	52.5
	1.70	1241	1016	853	714	613	563	431	349	257	198	135	110	93.4	82.1	51.9
	1.75	1199	974	814	687	593	546	422	338	250	195	133	109	91.8	80.2	51.1
	1.80	1153	928	778	658	571	525	412	324	243	189	130	107	88.9	78.1	49.4

Chapter III: Operation and maintenance

Safety Instructions

Please read these instructions carefully in order to ensure correct, safe and effective operation. This manual provides you very important guidance for installation and operation, which will guarantee your equipment with optimal performance and longer service life.

- For your safety, please do not open the batteries;
- As batteries contain lead which can potentially be harmful to the environment and health, and as batteries are connected to electricity, they must be installed, maintained and replaced by skilled personnel only.
- Used batteries must be recycled and disposed properly as improper disposal of batteries is harmful to the environment and health. Used batteries shall be properly disposed following relative regulations and laws.
- It is strictly forbidden to mix batteries with different specifications, manufacturers and capacities.
- All installations must comply with the safety regulations and norms. Read through our Operation Guide / Safety Instructions before starting any installation work.

Notices

				
Warning	Electrical shock	Protective eyewear and clothing required	Keep children away from the batteries	No short circuit
				
No flames and sparks	Recycle	Proper disposal	Read instructions	Electrolyte is highly corrosive

Operating Parameters

- Ambient temperature is -15℃~45℃ and the optimal operation temperature is 25℃±5℃.
- Ambient humidity less than RH 92%
- Altitude less than 4500m, if operation altitude more than 4500m, please make special reminder when confirm order.

Factors Influencing Capacity

Battery capacity consists both of nominal capacity and actual capacity, for nominal capacities of the FT series battery please refer to Table 1-1. Actual capacity is the real quantity of electricity battery discharge under certain condition, it equals to discharge current multiplied by discharge time, the unit is Ah.

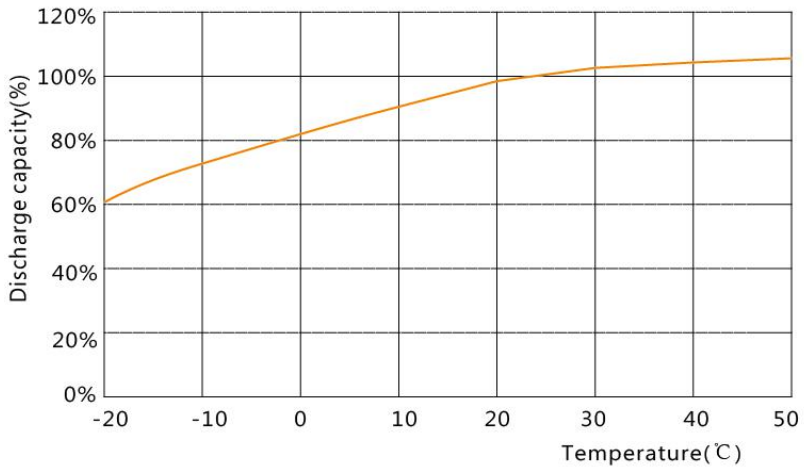
Battery capacity is directly related to discharge current, end voltage and discharge temperature.

Temperature Effect on Battery Capacity

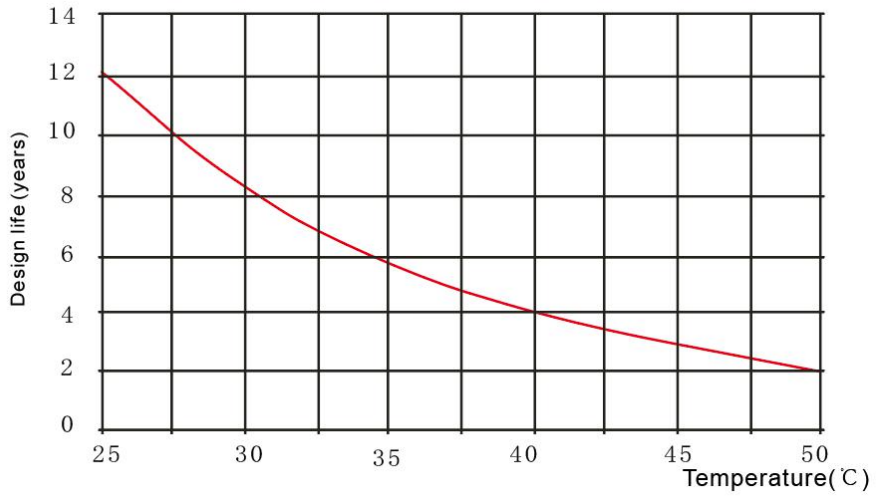
Figure 3-1 describes temperature effect on battery capacity (C10). For example, if temperature falls from 25℃ to 0℃, battery capacity will be 85% of the nominal capacity, low temperature will cause long term charge shortage, negative plates will be irreversibly sulfated and as a result the battery cannot be used normally.

As temperature rises, battery capacity will increase to a certain point. For example, if temperature rises from 25℃ to 35℃, battery capacity will be approximately 105% of the nominal capacity. From 35℃ to 50℃, the capacity increase is very low and if temperature rises beyond 50℃, there is no increase in battery capacity.

- Figure 3-1 temperature effect on battery capacity curve



- Figure 3-2 Design life and temperature curve



Charge

Floating charge

Charge method: 2.27V / cell with limited current of 0.3 C_{10} (A).

Charge voltage must be adjusted according to ambient temperature, temperature compensation coefficient is -3mV / cell /℃.

Floating charge voltage at different ambient temperature, as below table

Temperature（℃）	0	10	20	25	30	35
Floating charge voltage（V/cell）	2.33～2.36	2.30～2.33	2.27～2.30	2.25～2.28	2.24～2.27	2.22～2.25

Cycle application

Charge method: 2.40V / cell with limited current of 0.25 C_{10} (A).

Charge voltage must be adjusted according to ambient temperature, temperature compensation coefficient is -4mV / cell /℃.

When charged capacity is about 105-110% of discharged capacity or in constant voltage case, the charge current must be kept unchanged for 3 hours in the final stage of charge., charge is ended.

Operation

Warning

- The batteries are already charged when delivered, and are fitted with a protective cap on each terminal. They should be unpacked with care.
- Avoid short-circuiting terminals of opposite polarity, because these units are capable of discharging at a very high current especially if the lid or the container is damaged.

Unpacking the battery

- Each shipment is accompanied by a packing list
- The packing list should be checked, and the Sales Department should be told immediately of any missing items.

Setting up the battery racks

The structure should be assembled in accordance with instructions supplied with the equipment.

Racks

- Ensure that the stretchers and cross-members are correctly interlinked.
- Take up any irregularity in floor surface using shims
- Ensure that all frame members are correctly interlinked.
- Use the adjustable feet to take up irregularities in the floor surface.
- Metal racks should always be connected to the building earth in accordance with current regulations.

Mounting in a cabinet

Ensure that the cabinet:

- Is sufficiently strong to cope with the weight of the battery
- Is covered with a layer of insulation
- Is naturally ventilated.

Connection of cells

All connections should be insulated.

In series

The number of cells in series will determine the total float of voltage:

U = V x N

U --- Total float voltage

V --- Float voltage for one cell

N --- Number of cells

In parallel

The same battery may be connected in parallel to give higher current capability. This connection in parallel will be preferably carried out through an equipotential wiring for an equal current distribution in each string. There is no technical reason for limiting the number of strings, but for practical installation reasons, it is recommended not to exceed 4 strings in parallel especially if the battery is used in high discharge rates (standby time lower than 1 hour).

General recommendations:

- Do not wear clothing of synthetic material, to avoid the generation of static potentials
- Use insulated tools
- Place the cells beginning with the least accessible rows, spacing the cells as shown on the drawing.
- Consult the drawing for the correct position of the battery poles (positive=red color, negative=black color)
- Before attaching the inter-cell flexible cables, check that all terminals are in the correct position.
- The battery cells are connected in series, which is with a positive pole connected to a negative pole.
- Use only a damp cotton cloth for cleaning purposes.
- Tighten the nuts or bolts to the recommended levels of torque indicated on the operation guide.
- Always use insulated tools for fitting and torque up battery connections.

Storage

Storage Interval:

- Battery should be stored in fully charged state. It is strictly prohibited to storage after discharge.
- Battery storage location must be away from heat, sparks and smoke.
- Battery must be stored in an upright position, avoiding impacts of external force or abrupt loads. Safety valve should be tightened.
- It is strictly prohibited to stack battery without properly protective packaging.
- Battery can be stored in -10～45℃ environment.

<table>
<tr><th>Storage temperature</th><th>Maximum storage times / Freshening charge intervals</th><th>Recommended freshening charge method</th></tr>
<tr><td>-10～30℃</td><td>Every 6 months</td><td rowspan="2">Using constant current 0.1C_{10}A～0.15C_{10}A to charge battery bank till battery average voltage rises to equalizing charge voltage, then switch to constant voltage charging. Charging time is generally 10~20h.</td></tr>
<tr><td>31～45℃</td><td>Every 3 months</td></tr>
<tr><td colspan="3">Maximum storage time (Shelf life) is 18 months (25℃).</td></tr>
</table>

- Battery must be stored in a dry, ventilated and clean environment.
- Protect the battery from harsh weather, moisture, flooding, direct or indirect sun radiation, organic solvents, corrosive substances and gas

Maintenance

1. Cleaning Notes:

- Battery appearance, terminal area and working environment must be kept clean and dry.
- In battery cleaning process, avoid use of electrostatic cleaning tools.
- Clean the battery with damp cloth. Do not use of gasoline, alcohol or other organic solvents; also do not use cloth containing these substances.

2. Inspection and Maintenance

VRLA batteries are not maintenance-free batteries, battery operation process gradually changes with time. In order to ensure good battery usage, operational management and control are very important. To understand the operation status of batteries and equipment and to prevent accidental damage, regular maintenance is required. Periodically check and record the measurements using the following method for batteries used in UPS system room and base station (including outdoor station) site.

2.1 Monthly Maintenance Inspection Items

Item	Content	Standard	Maintenance
1-Temperature Detection	1-Measure and record battery terminal and container temperature by using infrared thermometer. 2-Use infrared thermometer to measure ambient temperature.	1-Ambient Temp: -20℃~+55℃ 2-Recommended Temperature: 25±5℃	1-Check that the battery temperature compensation functions are turned on and that the battery temperature probe is properly installed. 2-Check that the room temperature conditioning equipment such as air-conditioning is turned on.
2- Battery Float Voltage Measurement	Measure floating voltage on positive and negative terminal of the battery group with multimeter.	Measurement and control module display operating voltage differences within 0.05V	If the monitoring module shows inconsistency even after adjusting, replace or repair it.
3-Battery Appearance	Inspect the battery container for bulging, leakage and damage.	Normal Appearance	Confirm the reason for any abnormal appearance, if it affects normal use, replace the battery.
	Check for dirt stains	Clean Appearance	Clean dust and dirt with damp cloth
	Inspect the connection cables, terminals, etc. for oxidation, rust & other abnormalities	No oxidation, rust	If you find oxidation or rust, replace the connecting wire, and swab terminal with Vaseline etc.

Item	Content	Standard	Maintenance
4- Joints	Use hex or torque wrench to tighten loose bolts.	Securely connected	If found bolt loosened, tighten it
	1-Battery cables, terminals clean / non-corrosive. 2- Follow the installation sequence: 1. Spring washers 2. Flat washers 3, Nuts	No evidence of corrosion	If slight corrosion found after connecting bar removed, clean it with cloth. If severe corrosion, replace the connection bar and clean terminal with sandpaper after tightening.
5-Safety Valve Testing	Inspect for white crystalline or liquid surrounding the safety valve.	No crystalline or liquid surrounding the safety valve	1-For crystalline, use a dry cloth for cleaning. 2-If there is crystalline or liquid, clean it with a dry cloth. Check and tighten the safety valve

2.2 Quarterly Maintenance Inspection Items

In addition to the monthly maintenance items above, inspect the following items:

Item	Content	Standard	Maintenance
1- Measurement of each battery's floating voltage	Measure each battery's floating voltage by using multimeter.	Battery floating voltage differential pressure must meet the following values: 2V series 90 mV 6V series 240 mV 12V series 480 mV	If there are deviations from the reference values, first discharge the battery group and then equalizing charge. After equalizing charge is completed, change to float charge and run for two months. If there are still deviations from the reference values, replace and recycle the battery.
2-Use the equalizing charge to recover the batteries which have either lower capacity or discharge voltage than the other batteries.	Use the equalizing charge to charge the battery 10 hours or more. In case a battery has a severe deviation compared to other batteries, perform charge / discharge cycles three times.	Single battery discharge voltage in the battery group must meet the following values: 2V: 200mV, 6V: 350mV 12V: 600mV	If the battery performance cannot be recovered, it must be replaced.

2.3 Annual Maintenance Inspection Items

In addition to the quarterly maintenance items above, inspect the following items:

Item	Content	Standard	Maintenance
1- Discharge test	Disconnect the AC, take load discharge or discharge online method to check that discharge capacity is minimum 30%-40% of nominal capacity	At the end of discharge, battery voltage should be more than 1.90V/cell, differential pressure must meet the following values: 2V series 200mV 6V series 350mV 12V series 600mV	If the battery voltage is lower than a voltage reference value or the differential pressure is greater than the reference value, discharge the battery, then equalizing charge, then change to float charge and run for 1-2 months. If reference values still exceeded, contact our technical team for assistance.
2- Capacity Test	Use on-line or off-line intelligent discharge device for discharging batteries until the end voltage has reached 1.80V / cell	In back-up use the capacity to be maintained must be more than 80% and in energy storage use more than 60% of the reference capacity	Recovery test: measure and record various parameters specified in the monthly / quarterly maintenance items as well each battery's end voltage during the discharge test. If the battery performance cannot be recovered, replace and re-cycle the battery.
3-Measure and verify the controller parameters	1-Measure the limited charging current values. 2-Check that the equalizing charge starts and ends automatically. 3- Verify the automatic start of battery discharge protection.	Actual operation parameters to meet with the set parameters	In case power equipment and/or controller fails, arrange repair in a due course to ensure correct battery performance and avoidance of reduced battery lifetime.

Maintenance notes

- Operate and store batteries only in an upright position.
- Ensure that the battery installation complies with the design requirements and installation documents.
- Please use only insulated tools during operation and maintenance, any metal objects to be put on top of the battery is strictly prohibited.

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