



圣阳电源
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VALVE-REGULATED
SEALED LEAD
ACID BATTERY



FT
Series

SACRED SUN

Technical Manual

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Chapter I: Product Introduction

Product Characteristics

Advantages

- ✚ Design life: 12 years (25°C)
- ✚ EUROBAT Classification: Long life
- ✚ High discharge performance
- ✚ High gas recombination efficiency
- ✚ Maximum charge efficiency
- ✚ Low self-discharge rate
- ✚ Easy installation and handling
- ✚ Centralized venting system

Design Features

- | | |
|-------------------------|---|
| ✚ Positive plates | Thick flat pasted plate with lead-calcium-tin grid alloy; |
| ✚ Negative plates | Flat pasted plate with lead-calcium grid alloy; |
| ✚ Separators | Microporous AGM separator; |
| ✚ Container and lid | High-strength ABS (option: available in Flame Retardant UL94 V0 version); |
| ✚ Terminal posts | High-conductivity terminals with threaded inserts; |
| ✚ Posts sealing | Double sealing structure; |
| ✚ Vents | High-efficiency low pressure venting system; |
| ✚ Electrolyte | Absorbed sulfuric acid; |
| ✚ Plates suspension | Bottom supported; |
| ✚ Inter-cell connectors | Insulated rigid copper; |
| ✚ Terminal hardware | Stainless steel + Plastic cover. |

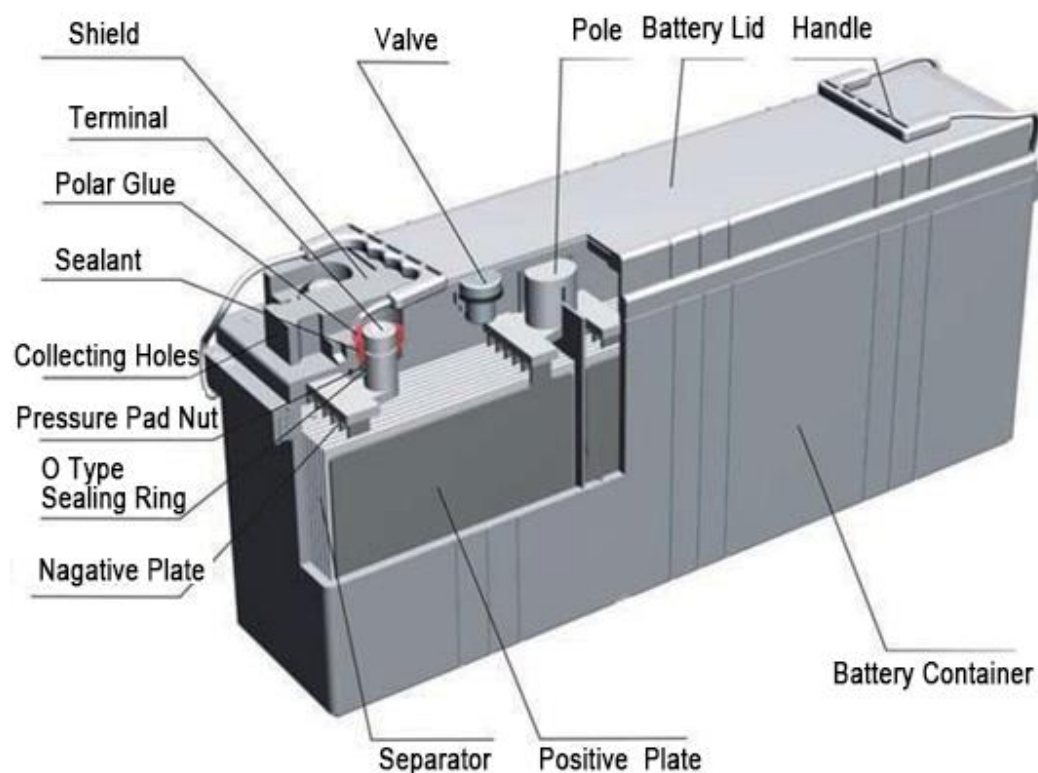
Main Applications

- ✚ Telecommunications
- ✚ Emergency power
- ✚ UPS
- ✚ Electrical Power plants and substation
- ✚ Transportation

Standards

- ✚ IEC60896-21/22: 2004
- ✚ BS 6290-4:1997
- ✚ YD/T2343-2011
- ✚ Eurobat guide
- ✚ Installation compliant with EN50272-2

Battery Construction



General Specifications

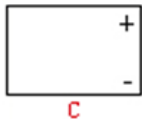
⚙️ FT series

■ Table 1-1 FT series battery general specifications

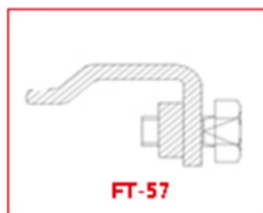
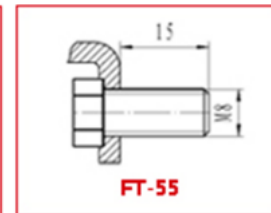
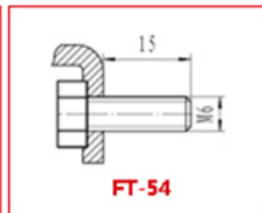
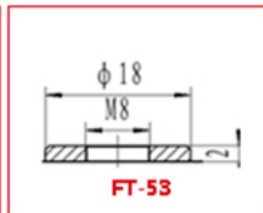
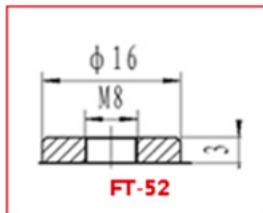
Battery Model	Nominal Voltage (V)	Nominal Capacity (Ah,25°C)	Dimensions (mm)			Weight (kg)	Short Circuit Current (A)	Internal Resistance (mΩ,25°C)	Terminal Type	Terminal Layout
		C ₁₀ 1.80V/cell	Length	Width	Height					
FTB12-80	12	80	395	110	288	26.0	2300	5.2	FT-52	C
FTB12-95	12	95	395	105	270	28.5	2500	4.8	FT-54	C
FTB12-100	12	100	395	110	288	32.0	2720	4.5	FT-57	C
FTB12-125	12	125	551	110	288	38.5	3000	4	FT-53	C
FTB12-150	12	150	551	110	288	45.0	3200	3.6	FT-57	C
FTA12-100	12	100	558	125	230	36.3	2650	4.8	FT-55	C
FTA12-125	12	125	558	125	270	43.6	3000	4	FT-55	C
FTA12-150	12	150	558	125	311	52.7	3200	3.6	FT-55	C
FTA12-175	12	175	558	125	311	54.0	3650	3.3	FT-55	C
FTA12-190	12	190	546	125	324	58.0	3750	4.1	FT-55	C
FTA12-200	12	200	546	125	324	59.0	3800	4.0	FT-55	C

Terminals

⚙️ Terminal Layout

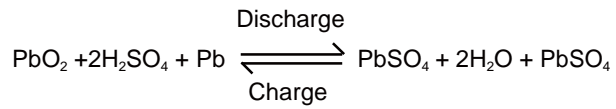


⚙️ Terminal Type



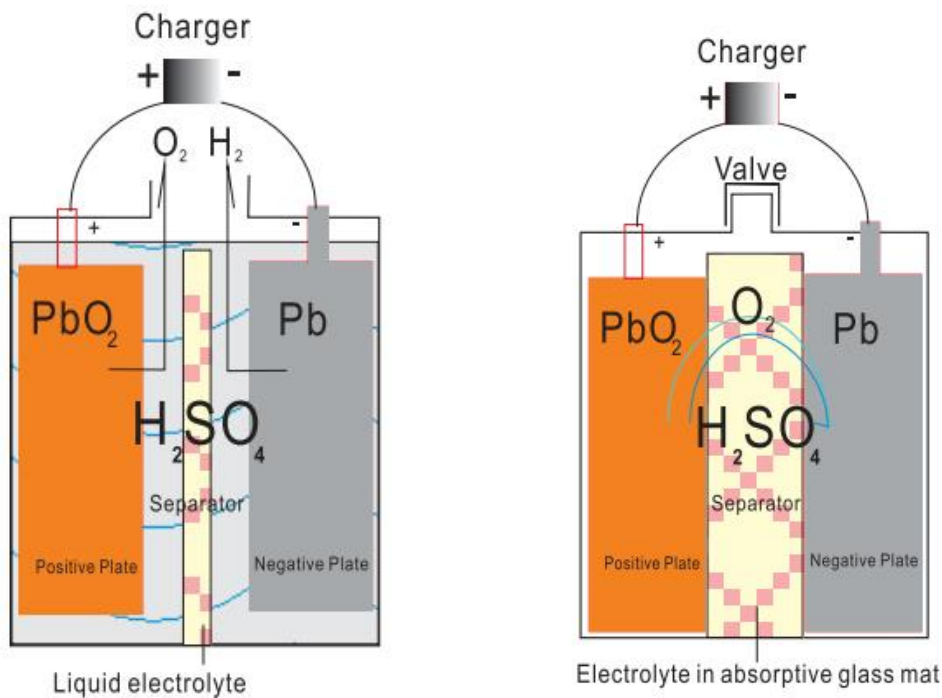
Working Principle

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



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:

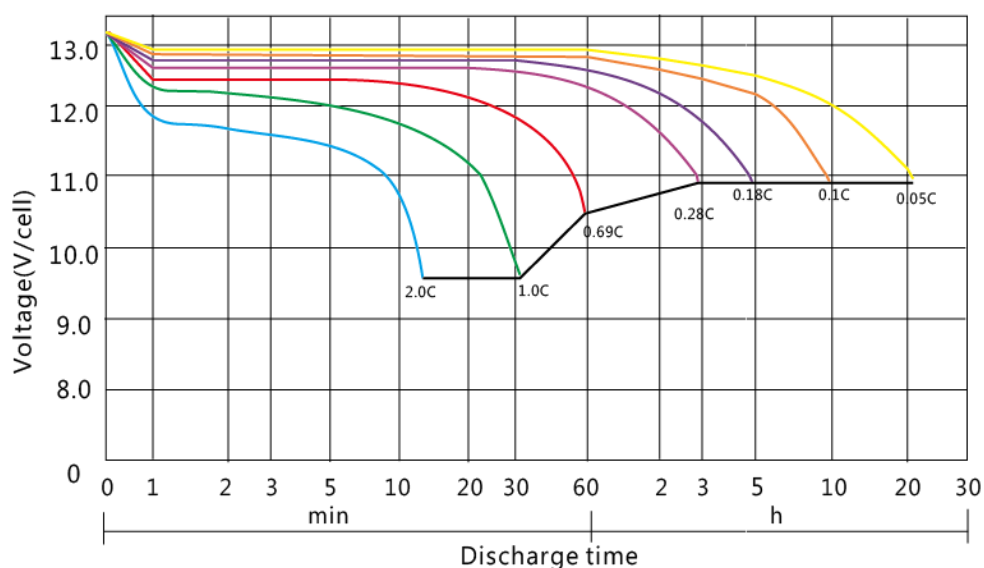


Chapter II: Electrical Characteristics

Discharge Curve

The battery capacity is directly related to the discharge current, end voltage and discharge temperature. In general, the smaller discharge current, the lower end voltage, the higher temperature will cause larger discharge capacity. Figure 2-1 describes the discharge curves of FT Series at different discharge rate at ambient temperature 25°C.

- Figure 2-1 Discharge curve under different discharge rates (25°C)

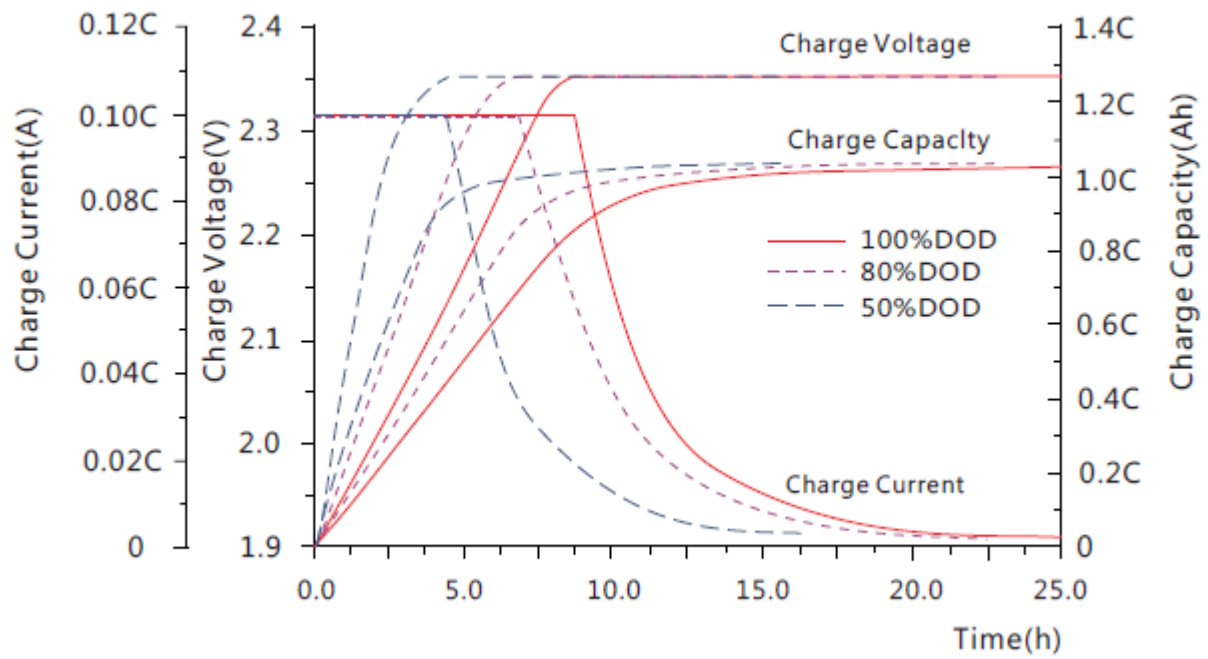


- Table 2-1 FT Series Battery End Voltage at Different Discharge Rate (25°C)

Discharge Rate (A)	End Voltage (V)
$I \leq 0.01C_{10}$	1.95
$0.01C_{10} < I \leq 0.05C_{10}$	1.90
$0.05C_{10} < I \leq 0.28C_{10}$	1.80
$0.28C_{10} < I \leq 0.55C_{10}$	1.75
$0.55C_{10} < I \leq 0.65C_{10}$	1.65

Charge Curve

- Figure 2-2 Charge curve under different depth of discharge (25°C)



Performance Data

⊗ Constant current discharge data

- Table 2-2 FT Series Battery Constant Current Discharge Data Sheet (Amperes, 25°C)

Constant Current Discharge Data Sheet (25°C)-----Amperes(A)															
Battery Type	End Voltage (V/cell)	Discharge Time													
		5 min	10 min	15 min	30 min	45 min	1 h	2 h	3 h	4 h	5 h	6 h	8 h	10 h	20 h
FTB12-80	1.60	219.9	175.9	145.4	99.6	69.5	52.9	31.6	23.40	17.7	14.70	12.40	9.40	8.21	4.29
	1.65	205.5	161.1	137.8	93.3	63.8	50.1	30.9	22.90	17.5	14.50	12.30	9.36	8.13	4.24
	1.70	188.9	145.0	127.0	87.1	59.2	45.6	30.1	22.50	17.3	14.40	12.25	9.33	8.09	4.22
	1.75	174.1	132.8	119.4	83.5	57.7	44.5	29.6	22.20	17.1	14.20	12.20	9.30	8.04	4.20
	1.80	155.3	123.4	109.9	76.8	51.8	41.2	28.8	21.90	17.0	14.00	12.00	9.20	8.00	4.17
FTB12-95	1.60	261.1	208.9	172.6	118.3	82.5	62.8	37.5	27.74	21.0	17.39	14.92	11.31	9.88	5.13
	1.65	244.0	191.3	163.6	110.8	75.8	59.5	36.7	27.27	20.8	17.29	14.82	11.26	9.79	5.04
	1.70	224.3	172.1	150.8	103.4	70.3	54.2	35.7	26.70	20.5	17.10	14.63	11.17	9.69	4.98
	1.75	206.8	157.8	141.8	99.2	68.5	52.8	35.2	26.41	20.2	16.82	14.44	11.12	9.60	4.93
	1.80	184.4	146.6	130.5	91.1	61.5	48.9	34.2	26.03	20.0	16.63	14.25	10.93	9.50	4.86
FTB12-100	1.60	274.9	219.9	181.7	124.5	86.8	66.1	39.5	28.41	23.2	18.73	15.95	12.38	10.40	5.58
	1.65	256.9	201.4	172.2	116.7	79.8	62.6	38.6	27.62	22.8	18.49	15.95	12.30	10.24	5.53
	1.70	236.1	181.2	158.8	108.9	74.0	57.0	37.6	27.06	22.4	18.33	15.71	12.22	10.14	5.50
	1.75	217.6	166.1	149.3	104.4	72.1	55.6	37.0	26.75	22.0	18.10	15.56	12.06	10.08	5.46
	1.80	194.1	154.3	137.4	95.9	64.8	51.5	36.0	26.27	21.8	17.86	15.40	11.90	10.0	5.39
FTB12-125	1.60	343.6	274.9	227.1	155.7	108.5	82.6	49.4	35.52	29.0	23.41	19.94	15.48	13.00	6.98
	1.65	321.1	251.8	215.3	145.8	99.7	78.2	48.3	34.52	28.5	23.12	19.94	15.38	12.8	6.91
	1.70	295.2	226.5	198.5	136.1	92.5	71.3	47.0	33.83	28.0	22.92	19.64	15.28	12.8	6.88
	1.75	272.1	207.6	186.6	130.5	90.2	69.5	46.3	33.43	27.5	22.62	19.44	15.08	12.60	6.85
	1.80	242.7	192.8	171.8	119.9	81.0	64.4	45.0	32.84	27.3	22.32	19.25	14.88	12.50	6.83
FTB12-150	1.60	412.3	329.8	272.6	186.8	130.2	99.2	59.3	42.62	34.8	28.10	23.93	18.57	15.60	8.38
	1.65	385.3	302.1	258.4	175.0	119.7	93.9	57.9	41.43	34.2	27.74	23.93	18.45	15.36	8.30
	1.70	354.2	271.8	238.2	163.3	111.0	85.5	56.4	40.60	33.6	27.50	23.57	18.33	15.36	8.25
	1.75	326.5	249.1	223.9	156.6	108.2	83.4	55.5	40.12	33.0	27.14	23.33	18.10	15.12	8.22
	1.80	291.2	231.4	206.1	143.9	97.2	77.2	54.0	39.40	32.7	26.79	23.10	17.86	15.0	8.19

■ Table 2-2 FT Series Battery Constant Current Discharge Data Sheet (Amperes, 25°C)

Constant Current Discharge Data Sheet (25°C)----- Amperes(A)															
Battery Type	End Voltage (V/cell)	Discharge Time													
		5 min	10 min	15 min	30 min	45 min	1 h	2 h	3 h	4 h	5 h	6 h	8 h	10 h	20 h
FTA12-100	1.60	266.0	221.0	182.6	125.2	87.3	66.5	39.7	28.64	23.10	18.88	16.08	12.48	10.48	5.63
	1.65	253.2	202.4	173.1	117.3	80.2	62.9	38.8	27.84	22.10	18.64	16.08	12.40	10.32	5.58
	1.70	237.3	182.1	159.6	109.4	74.4	57.3	37.8	27.28	21.90	18.48	15.84	12.32	10.32	5.54
	1.75	218.7	166.9	150.0	104.9	72.5	55.9	37.2	26.96	21.30	18.24	15.68	12.16	10.16	5.52
	1.80	195.1	155.1	138.1	96.4	65.1	51.8	36.2	26.48	20.90	18.00	15.52	12.00	10.0	5.50
FTA12-125	1.60	345.4	260.3	211.2	151.8	109.8	83.8	47.2	34.0	26.5	22.4	19.08	15.34	12.75	7.00
	1.65	319.5	241.9	197.6	143.4	104.4	80.6	45.7	33.2	26.1	22.1	18.93	15.26	12.69	6.97
	1.70	295.1	224.8	185.3	135.6	99.7	77.2	44.4	32.5	25.6	21.9	18.79	15.18	12.63	6.95
	1.75	273.2	210.0	174.4	128.9	95.4	74.2	43.1	31.8	25.3	21.7	18.64	15.10	12.57	6.91
	1.80	243.9	190.0	160.0	120.5	90.0	71.0	42.0	31.3	25.0	21.5	18.50	15.00	12.50	6.88
FTA12-150	1.60	414.4	331.5	273.9	187.7	130.9	99.7	59.6	42.96	35.0	28.32	24.12	18.72	15.72	8.45
	1.65	387.2	303.6	259.7	175.9	120.3	94.4	58.2	41.76	34.4	27.96	24.12	18.60	15.48	8.36
	1.70	356.0	273.2	239.4	164.1	111.5	86.0	56.7	40.92	33.8	27.72	23.76	18.48	15.48	8.32
	1.75	328.1	250.3	225.0	157.3	108.8	83.8	55.8	40.44	33.2	27.36	23.52	18.24	15.24	8.28
	1.80	292.7	232.6	207.2	144.6	97.7	77.6	54.2	39.72	33.0	27.00	23.28	18.00	15.0	8.26
FTA12-175	1.60	483.5	386.8	307.0	199.0	142.0	116.3	69.5	50.10	40.9	33.00	28.10	21.90	18.40	9.90
	1.65	451.8	354.2	300.9	189.0	140.4	110.1	67.9	48.70	40.2	32.60	28.10	21.80	18.2	9.80
	1.70	415.3	318.7	279.3	186.0	130.1	100.3	66.2	47.80	39.5	32.30	27.70	21.50	18	9.70
	1.75	382.8	292.1	262.5	183.6	126.9	97.7	65.1	47.20	38.8	31.90	27.40	21.30	17.90	9.65
	1.80	341.4	271.3	241.7	166.0	113.9	90.6	63.3	46.40	38.5	31.50	27.10	21.00	17.5	9.60
FTA12-190	1.60	506.0	385.7	306.6	198.3	141.3	116.3	75.4	53.70	43.8	35.30	30.10	23.40	19.60	10.60
	1.65	490.5	374.4	300.5	190.0	139.6	112.5	73.7	52.10	43.1	34.90	30.10	23.30	19.4	10.50
	1.70	450.9	346.0	290.1	186.0	138.3	108.9	71.8	51.20	42.3	34.60	29.70	23.00	19.3	10.30
	1.75	415.6	317.1	274.0	183.0	137.8	106.1	70.7	50.60	41.6	34.20	29.40	22.80	19.10	10.25
	1.80	370.7	294.6	262.4	163.9	123.7	98.3	68.7	49.70	41.3	33.80	29.10	22.50	19.0	10.20
FTA12-200	1.60	538.5	426.0	348.0	250.3	164.5	132.9	79.4	54.8	42.5	36.4	31.7	24.6	20.6	11.2
	1.65	516.3	404.8	330.0	234.5	160.4	125.8	77.6	53.1	41.7	36.0	31.3	24.5	20.4	11.1
	1.70	474.6	364.2	319.0	218.8	148.7	114.6	73.8	50.7	40.2	34.6	30.7	24.2	20.3	10.8
	1.75	437.5	333.8	300.0	209.8	145.0	111.7	72.4	50.4	39.7	34.3	30.4	24.0	20.1	10.8
	1.80	390.2	310.1	276.2	192.8	130.2	103.5	71.3	50.0	39.0	34.0	30.1	23.7	20.0	10.7

 Constant power discharge data

■ Table 2-3 FT Series Battery Constant Power Discharge Data Sheet (W/cell, 25°C)

Constant Power Discharge Data Sheet (25°C)-----Watt (W)															
Battery Type	End Voltage (V/cell)	Discharge Time													
		5 min	10 min	15 min	30 min	45 min	1 h	2 h	3 h	4 h	5 h	6 h	8 h	10 h	20 h
FTB12-80	1.60	373.3	328.0	265.0	172.0	124.0	100.6	60.4	44.40	33.8	28.00	24.20	18.10	15.80	8.27
	1.65	357.5	312.0	255.0	164.0	121.0	99	59.9	43.80	33.6	27.90	24.00	18.05	15.76	8.24
	1.70	339.7	301.0	247.0	158.0	117.0	97.5	59.1	43.20	33.4	27.70	23.80	18.00	15.72	8.20
	1.75	320.0	282.0	230.0	151.0	113.0	94.5	58.8	42.80	33.2	27.50	23.60	17.95	15.69	8.17
	1.80	297.8	265.0	219.0	145.0	109.0	91.4	58.1	42.50	33	27.30	23.40	17.90	15.65	8.14
FTB12-95	1.60	443.3	389.5	327.8	204.3	148.2	125.4	71.73	52.73	40.19	33.25	28.69	21.57	19.00	9.82
	1.65	424.5	370.5	308.8	194.8	143.5	123.5	71.16	52.06	39.90	33.16	28.50	21.52	18.62	9.79
	1.70	403.4	357.2	292.6	188.1	139.7	121.6	70.21	51.30	39.71	32.97	28.22	21.45	18.05	9.73
	1.75	380.0	334.4	278.4	179.6	134.9	117.8	69.83	50.83	39.43	32.68	28.03	21.38	17.67	9.68
	1.80	353.6	314.5	262.2	172.0	130.2	114.0	68.97	50.45	39.14	32.40	27.84	21.28	17.1	9.61
FTB12-100	1.60	466.7	410.0	345.0	215.0	156.0	132	75.5	55.50	42.3	35.00	30.20	22.70	20.00	10.34
	1.65	446.8	390.0	325.0	205.0	151.0	130	74.9	54.80	42	34.90	30.00	22.65	19.6	10.30
	1.70	424.6	376.0	308.0	198.0	147.0	128	73.9	54.00	41.8	34.70	29.70	22.58	19	10.24
	1.75	400.0	352.0	293.0	189.0	142.0	124	73.5	53.50	41.5	34.40	29.50	22.50	18.60	10.19
	1.80	372.2	331.0	276.0	181.0	137.0	120.0	72.6	53.10	41.2	34.10	29.30	22.40	18	10.12
FTB12-125	1.60	583.3	512.0	420.0	255.0	204.0	163	94.4	65.50	53.5	44.00	37.60	28.50	25.00	12.92
	1.65	558.5	488.0	403.0	248.0	198.0	153	93.1	64.40	53	43.80	37.30	28.40	24.96	12.90
	1.70	530.8	470.0	390.0	241.0	193.0	152	92.5	63.80	52.3	43.60	37.10	28.30	24.93	12.88
	1.75	500.0	440.0	348.0	233.0	186.0	148	91.3	62.80	51.8	43.00	36.80	28.20	24.90	12.86
	1.80	465.3	414.0	321.0	226.0	179.0	144.0	90.7	61.80	51.5	42.70	36.60	28.00	24.7	12.81
FTB12-150	1.60	706.0	568.0	491.0	312.0	245.0	187	113.2	78.60	63.5	52.80	45.10	34.20	29.80	15.50
	1.65	675.0	535.0	476.0	305.0	238.0	182	112.3	77.30	63.1	52.50	44.80	34.10	29.75	15.45
	1.70	642.0	498.0	450.0	295.0	231.0	175	110.9	76.50	62.8	52.30	44.50	34.00	29.7	15.40
	1.75	605.0	467.0	432.0	288.0	223.0	171	110.2	75.30	62.2	51.60	44.20	33.80	29.60	15.35
	1.80	563.0	450.0	415.0	279.0	215.0	165.0	108.8	74.20	61.8	51.20	43.80	33.60	29.5	15.30

■ Table 2-3 FT Series Battery Constant Power Discharge Data Sheet (W/cell, 25°C)

Constant Power Discharge Data Sheet (25°C)-----Watt (W)															
Battery Type	End Voltage (V/cell)	Discharge Time													
		5 min	10 min	15 min	30 min	45 min	1 h	2 h	3 h	4 h	5 h	6 h	8 h	10 h	20 h
FTA12-100	1.60	485.4	416.8	342.4	214.4	178.4	134.4	80.0	54.40	44.64	36.00	30.88	24.00	20.16	10.88
	1.65	460.4	393.6	323.2	206.4	173.6	129.6	78.64	53.20	44.16	35.84	30.80	23.84	20.13	10.84
	1.70	428.0	366.4	313.6	198.4	168.8	128	77.36	52.40	43.52	35.68	30.64	23.76	20.10	10.80
	1.75	403.2	338.4	286.4	192.0	166.4	124	76.64	51.84	43.04	35.44	30.40	23.60	20.00	10.76
	1.80	375.2	310.4	265.6	184.0	161.6	121.6	74.6	51.44	42.8	35.12	30.24	23.44	19.76	10.71
FTA12-125	1.60	620.5	480.9	398.7	292.6	216.5	167.6	95.8	69.1	53.7	45.2	38.48	30.84	25.51	13.80
	1.65	574.0	446.9	373.0	276.3	205.9	161.2	92.7	67.5	52.9	44.8	38.16	30.67	25.39	13.74
	1.70	530.2	415.3	349.8	261.2	196.6	154.5	90.2	66.1	52.0	44.3	37.88	30.51	25.26	13.68
	1.75	490.8	387.9	329.2	248.5	188.1	148.4	87.6	64.7	51.3	43.8	37.59	30.35	25.14	13.62
	1.80	438.2	351.1	302.1	232.2	177.5	142.0	85.3	63.6	50.7	43.5	37.30	30.15	25.00	13.55
FTA12-150	1.60	706.0	568.0	491.0	322.0	268.0	213	120.0	81.60	67	54.00	46.30	36.00	30.50	16.30
	1.65	675.0	535.0	476.0	310.0	260.0	210	118.0	79.80	66.2	53.70	46.20	35.80	30.5	16.27
	1.70	642.0	498.0	450.0	302.0	253.0	205	116.0	78.60	65.3	53.50	45.90	35.60	30.2	16.23
	1.75	605.0	467.0	432.0	293.0	250.0	202	115.0	77.80	64.5	53.10	45.60	35.40	30.20	16.20
	1.80	563.0	450.0	415.0	284.0	242.0	196.0	112.0	77.10	64.2	52.70	45.30	35.10	29.6	16.15
FTA12-175	1.60	824.0	663.0	548.0	376.0	293.0	222	144	97.20	78.2	65.00	55.50	43.00	36.80	19.00
	1.65	788.0	624.0	535.0	362.0	283.0	216	139.3	93.10	77.2	64.70	54.70	43.80	36.10	18.97
	1.70	749.0	581.0	509.0	352.0	261.0	206	135.0	91.70	76.2	62.40	53.60	43.50	35.32	18.94
	1.75	706.0	545.0	490.0	342.0	253.0	202	134.0	90.80	75.3	62.00	53.20	43.30	35.20	18.90
	1.80	657.0	525.0	468.0	329.0	230.0	182	131.0	90.00	74.9	61.40	52.90	43.00	34.50	18.86
FTA12-190	1.60	882.6	710.2	570.0	412.5	295.2	262.1	150.0	110.0	83.8	67.50	57.90	44.90	38.65	20.40
	1.65	844.0	668.4	550.0	389.3	290.6	258.4	147.8	107.0	82.7	67.20	57.70	44.70	38.49	20.30
	1.70	802.2	622.3	520.0	387.0	283.0	252.3	144.6	104.0	81.6	66.90	57.40	44.40	38.35	20.10
	1.75	756.3	583.7	483.0	384.0	276.8	248.6	143.6	103.0	80.7	66.40	57.00	44.20	38.22	19.90
	1.80	703.7	562.3	473.0	340.0	249.1	241.2	140.3	100.0	80.3	65.70	56.60	43.90	37.46	19.80
FTA12-200	1.60	929.1	747.6	600.0	456.0	332.8	250.3	157.9	110.7	85.2	71.1	60.9	47.3	40.7	21.5
	1.65	888.4	703.6	578.9	449.0	323.0	243.6	155.6	107.6	83.1	70.7	60.7	47.1	40.5	21.4
	1.70	844.4	655.1	547.4	440.0	297.9	232.3	150.0	103.2	81.1	70.4	60.4	46.7	40.4	21.2
	1.75	796.1	614.4	508.4	417.9	291.4	227.8	146.0	101.4	80.0	69.9	60.0	46.5	40.2	20.9
	1.80	740.7	591.9	497.9	395.8	262.2	209.4	141.2	100.3	77.9	69.2	59.6	46.2	39.4	20.8











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

Operation Conditions and Paramters

⚙️ Temperature range is $-15^{\circ}\text{C}\sim 50^{\circ}\text{C}$, the optimal operation temperature is $20^{\circ}\text{C}\sim 30^{\circ}\text{C}$, max. ambient humidity is $\leq 95\%$, height above sea level less than 3000 Meter

⚙️ **Charge current-limiting valve: charge current-limiting valve range is $0.1\text{C}_{10}\sim 0.2\text{C}_{10}$**

According to the grid condition of the BTS, we divided the grid conditions into five types, see the table 3-1 below:

Table 3-1 Grid conditions definition

Type I: Total power failure time per month <10 hours
Type II: Total power failure time per week <10 hours
Type III: Power failure time every day ≥ 2 hours, but <4 hours
Type IV: Power failure time every day ≥ 4 hours, but <8 hours
Type V: (Including no grid): Power failure time every day ≥ 8 hours

In case the grid condition is type V, contact our technical team for assistance.

See below Table 3-2 for the recommended rectifier parameters settings (48V system), other system voltage value are calculated according to the parameters.

Table 3-2 Recommended settings for rectifier parameters (48V system, 25°C)

No.	Parameter type		I type power supply	II type power supply	III type power supply
1	Floating charge voltage (V)		54	54	54
2	Equalizing charge voltage (V)		56.4	56.4	56.4
3	Max. Charge current limitation (A/group)		0.20C ₁₀		
4	High voltage alarm voltage (V)		58.8	58.8	58.8
5	Low voltage alarm voltage (V)		47	47	47
6	Low voltage load disconnect-LVLD (V)		46.5	46.5	46.5
7	Low voltage battery disconnect-LVBD (V)		45	45	45
8	The battery protection voltage (V)		43.2	43.2	44.4
9	reset voltage (V)		50	50	50
10	condition for starting equalizing charge (fulfill one of the conditions)	discharging voltage as the conditions(V)	49.2	49.2	49.5
		discharging time as the conditions(h)	1.0	1.0	1.0
		discharging capacity as the conditions(Ah)	15% C ₁₀	10% C ₁₀	10% C ₁₀
		initial charging current as the conditions(A)	≥0.05C ₁₀	≥0.05C ₁₀	≥0.05C ₁₀
11	Equalizing charging period(day)		180	90	60
12	condition for ending equalizing charge (fulfill one of the conditions)	equalizing charge time as the conditions (h)	10	10	15
13		the charge coefficient as the condition	1.05~1.10	1.05~1.10	1.10~1.15
14		the equalizing charge tail current as the condition(A)	0.01C ₁₀	0.01C ₁₀	0.005C ₁₀
15	temperature compensation	temperature compensation coefficient (mV/°C/cell) (reference temperature :25°C)	-3.5	-3.5	-3.5
		High limited voltage of floating charging temperature compensation (V)	56.16		
		Low limited voltage of floating charging temperature compensation (V)	51.84		

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.

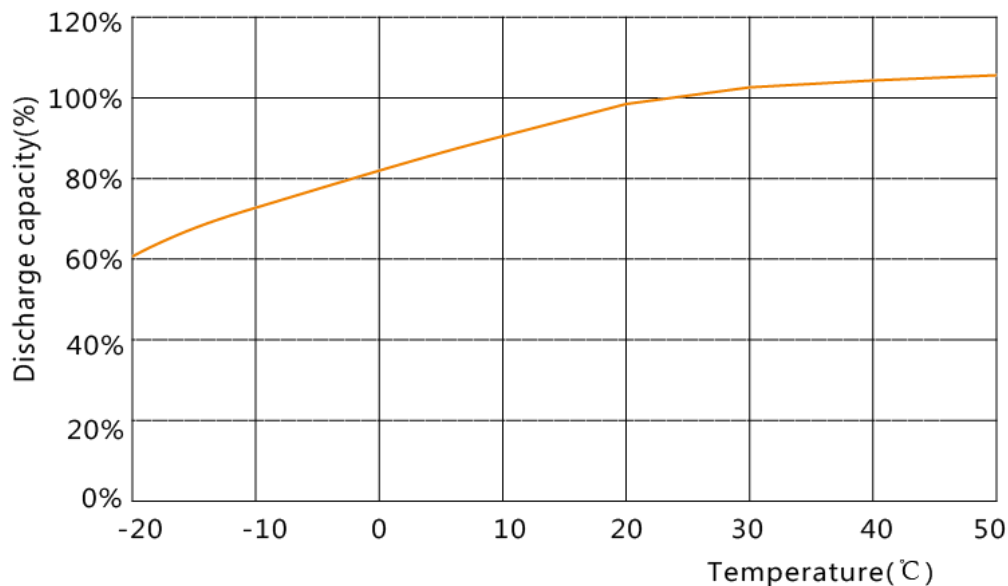
Battery capacity is directly related to discharge current, end voltage and discharge temperature.

Temperature Effect on Battery Capacity

Figure 3-1 describes temperature effect on battery capacity (C10). For example, if temperature falls from 25°C to 0°C, 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°C to 35°C, battery capacity will be approximately 105% of the nominal capacity. From 35°C to 50°C, the capacity increase is very low and if temperature rises beyond 50°C, there is no increase in battery capacity.

- Figure 3-1 temperature effect on battery capacity curve



Floating charge

FT series batteries can be used in floating and cycle application.

Floating operation is the best operation condition for the battery. In floating operation, if the battery is kept at fully charged state, the battery can reach the longest service life. At the ambient temperature of 25°C, recommended floating charge voltage setting value is 2.25V/ cell. In such a condition, it takes 72~96h for the battery to be fully charged. In order to achieve optimum performance, floating charge voltage must be adjusted according to the ambient temperature (Table 3-3).



- Table 3-3 Floating charge voltage at different temperatures

Ambient Temperature(°C)	Floating Charge Voltage (V/cell)
0	2.34
5	2.32
10	2.31
15	2.29
20	2.27
25	2.25
30	2.24
35	2.22
40	2.20
45	2.18
50	2.16

Recharge

Recharge the battery immediately after discharge according to the method described below:

Charge the battery with constant current of no more than $0.2C_{10}(A)$, until the battery voltage rises to 2.33~2.37V / cell, then change to constant voltage charge of 2.33~2.37V / cell until the charge completed. Meeting one of the following two conditions can be regarded as fully charged.

-  Refer to the required charge time specified in the Table 3-4
-  In constant voltage case, the charge current must be kept unchanged for 3 hours in the final stage of charge.

Charge voltage shall be adjusted according to the ambient temperature, temperature compensation coefficient is $-3.5mV/°C$ / cell.

- Table 3-4 Required charge time in different depth of discharge

Depth of discharge(%)	Charge current at constant current charge period (A)	Constant current charge time (h)	Charge voltage at constant voltage charge period (V/cell)	Constant voltage charge time(h)
20	0.1C ₁₀	1.6	2.35	12
	0.15C ₁₀	1.2	2.35	10
50	0.1C ₁₀	4.3	2.35	18
	0.15C ₁₀	3.3	2.35	16
80	0.1C ₁₀	6.8	2.35	20
	0.15C ₁₀	5.5	2.35	18
100	0.1C ₁₀	8.7	2.35	24
	0.15C ₁₀	6.8	2.35	22

Temperature Effect on Battery Design Life

Higher temperature will speed up battery grid corrosion and water loss, thus greatly shorten the battery life. If temperature is above 25°C, the service life of the battery will be shortened by half when temperature increases by 10°C. For example, if the design life of a battery is 10 years at 25°C, its service life will be shortened down to 5 years if ambient temperature is always at 35°C. Refer to the following formula:

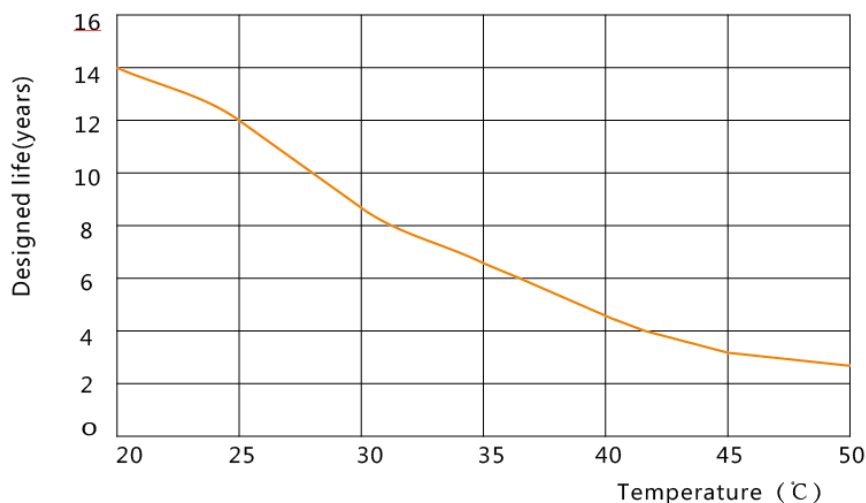
$$t_{25^{\circ}\text{C}} = t_T \times 2^{(T-25)/10}$$

T --- Ambient temperature.

t_T --- Design life at temperature of T.

t_{25°C} --- Design life at temperature of 25°C.

- Figure 3-2 Temperature effect on battery design life



Charge Requirement

⚙ Equalizing Charge

Equalizing charge is needed in the following cases:

- ✚ When there are more than two batteries in a battery string with voltage of lower than 2.18V / cell.
- ✚ The battery has been in floating operation more than 3 months.
- ✚ Recommended charge method as follows:

Charge the battery with constant current of no more than $0.15C_{10}(A)$, until the battery voltage rises to 2.35V / cell, then change to constant voltage charge of 2.35V / cell for approximately 24 hours.

⚙ Recharge

Recharge is needed in the following cases, the recharge method is same as described above for equalizing charge.

- ✚ After battery is discharged.
- ✚ After finishing battery system installation.

⚙ The following condition can be regarded as the fully charged.

In constant voltage charge period, the charge current must be kept unchanged for 3 hours in the final stage of charge.

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 $-10\sim 45^{\circ}\text{C}$ environment.

Storage temperature	Maximum storage times / Refreshing charge intervals	Recommended refreshing charge method
-10~30℃	Every 6 months	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.
31~45℃	Every 3 months	
Maximum storage time (Shelf life) is 18 months (25℃).		

- ✚ 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.

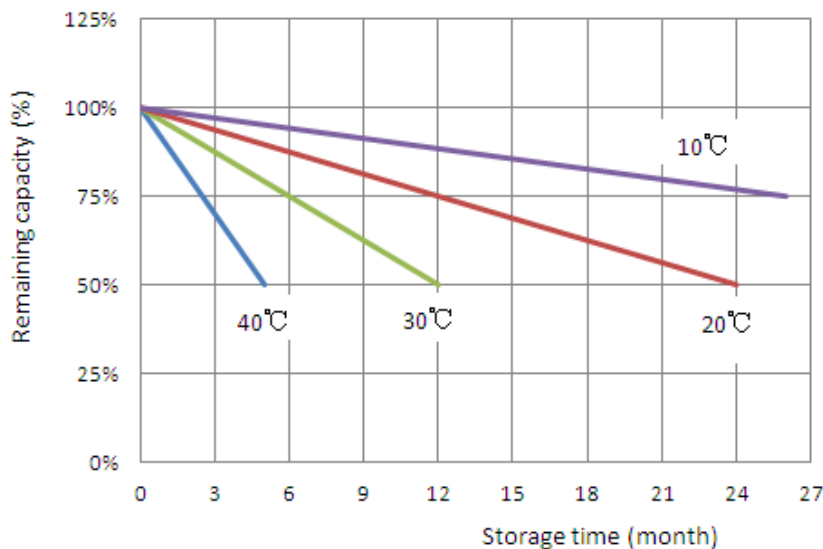
The state of charge can be verified by testing the open circuit voltage after storage for 24 hours at 25℃.

■ Table 3-3 Open circuit voltage at different state of charge

State of Charge	Voltage (V/cell)
100%	≥2.18
80%	≥2.15
60%	≥2.10
40%	≥2.07
20%	≥2.04

Testing the open circuit of the stored battery will show whether a freshening charge is needed. If the voltage drops to 2.15V/cell, the battery shall be freshening charged in time.

■ Figure 3-3 Remaining capacity curve at different temperature and different storage time



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°C~+55°C 2-Recommended Temperature: 25±5°C	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 before 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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