REXC series

6REXC240

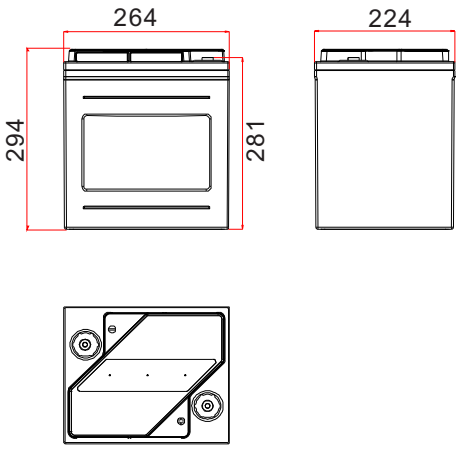
Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Home energy storage system
- Smart power grids and microgrid system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Dimension



Parameter

Nominal Voltage	6V
Capacity	240Ah (100hr to 1.85V/cell @25°C)
	200Ah (10hr to 1.80V/cell @25°C)
Typical Weight	47.5kg
Internal Resistance	Approx 1.11mΩ (acc. to IEC60896-21 clause 6.3)
Short-Circuit Current	3939A
Self Discharge	Residual capacity is above 90% after 90 days storage(25°C)
Temperature Ranges	Operation(recommended):15°C~25°C
	Operation(maximum):-20°C~50°C
Max. charging current	60A
Max. constant charging current	40A
Charge Voltage	Floating: 2.25V/cell(25°C)
	Equalizing/Cycle: 2.30V/cell(25°C)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N.m

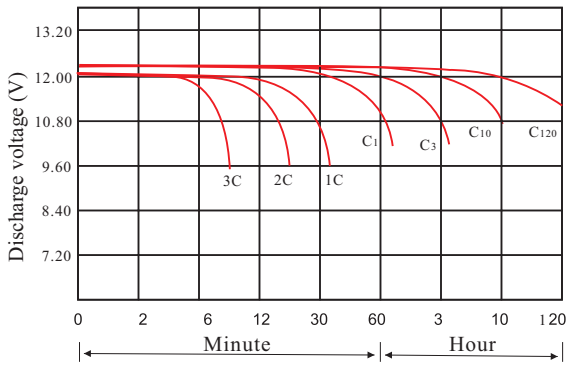
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	60min	3hour	5hour	8hour	10hour	24hour	48hour	72hour	120hour
1.75V	120.64	55.47	38.51	26.99	20.49	10.02	5.17	3.54	2.25
1.80V	112.96	53.76	37.65	26.45	20.00	9.86	5.06	3.47	2.20
1.83V	105.81	52.05	36.69	26.03	19.61	9.64	4.95	3.39	2.15
1.85V	101.97	50.99	36.37	25.71	19.42	9.53	4.93	3.37	2.13
1.88V	97.71	49.92	35.95	25.39	19.32	9.44	4.89	3.34	2.12
1.90V	90.56	47.79	34.99	24.75	18.83	9.32	4.76	3.25	2.07

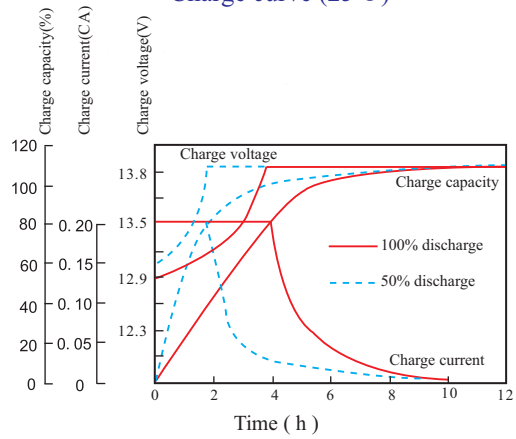
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hour	2hour	3hour	4hour	5hour	6hour	8hour	10hour
1.75V	615.3	439.5	241.7	142.8	109.9	87.9	74.7	65.9	51.6	43.9
1.80V	606.3	433.1	238.2	140.7	108.3	86.6	73.6	65.0	50.9	43.3
1.83V	594.3	424.5	233.5	138.0	106.1	84.9	72.2	63.7	49.9	42.5
1.85V	582.4	416.0	228.8	135.2	104.0	83.2	70.7	62.4	48.9	41.6
1.88V	567.5	405.3	222.9	131.7	101.3	81.1	68.9	60.8	47.6	40.5

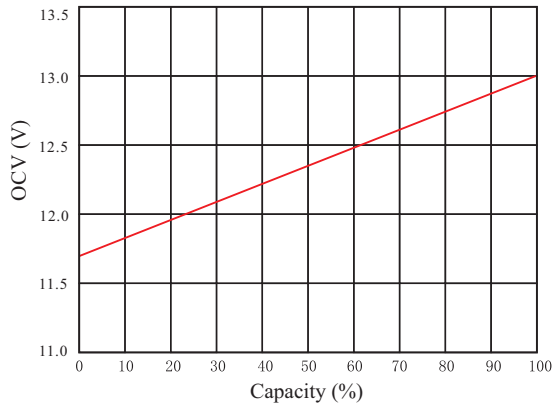
Discharge curve at different rate (25℃)



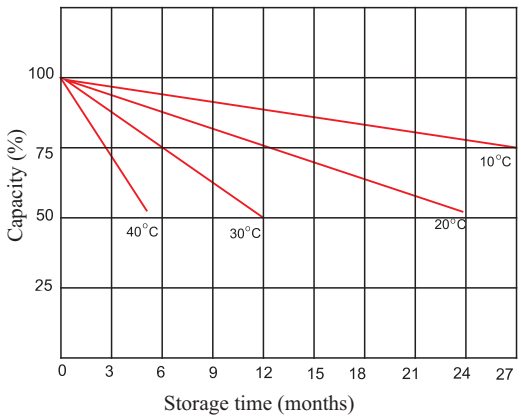
Charge curve (25℃)



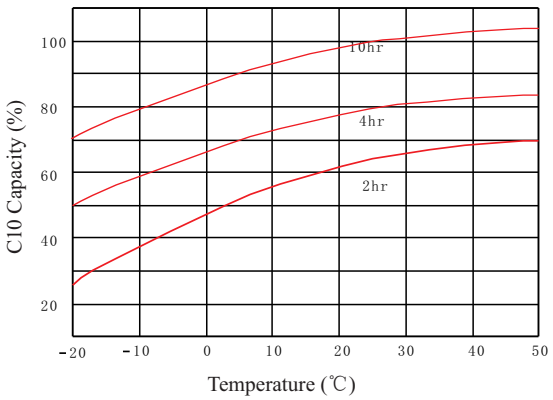
Capacity vs OCV curve



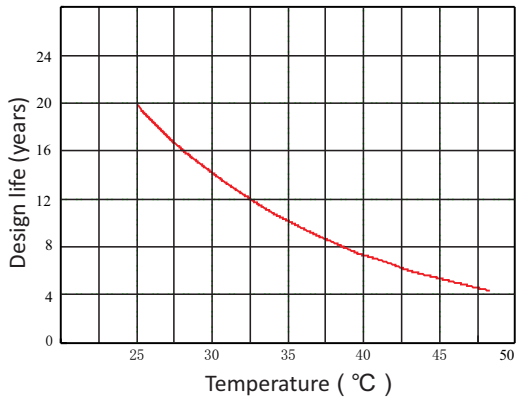
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature

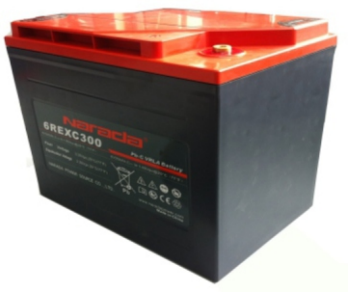


Subject to revision without prior notice

6REXC240 -01-N-EN (ver 1.0-February.2016) Subject to revision without prior notice.E.&.O.E.

12REXC series

6REXC300



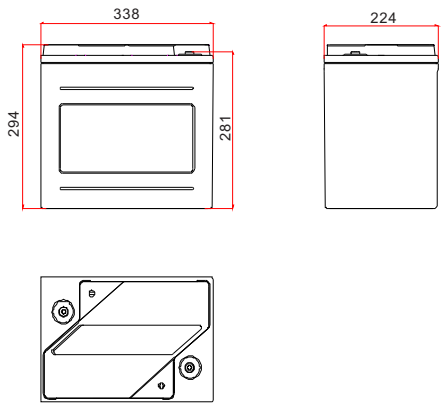
Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Home energy storage system
- Smart power grids and microgrid system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Dimension



Parameter

Nominal Voltage	6V
Capacity	300Ah (100hr to 1.85V/cell @25°C)
	250Ah (10hr to 1.80V/cell @25°C)
Typical Weight	61kg
Internal Resistance	Approx 1.35mΩ (acc. to IEC60896-21 clause 6.3)
Short-Circuit Current	4619A
Self Discharge	Residual capacity is above 90% after 90 days storage(25°C)
Temperature Ranges	Operation(recommended):15°C~25°C
	Operation(maximum):-20°C~50°C
Max. charging current	75A
Max. constant charging current	50A
Charge Voltage	Floating: 2.25V/cell(25°C)
	Equalizing/Cycle: 2.30V/cell(25°C)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N.m

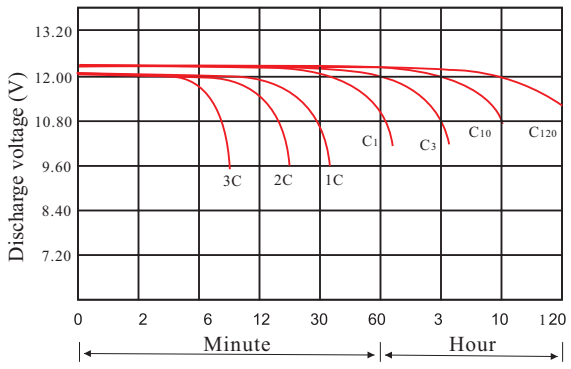
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	60min	3hour	5hour	8hour	10hour	24hour	48hour	72hour	120hour
1.75V	150.80	69.33	48.13	33.73	25.61	12.52	6.47	4.43	2.81
1.80V	141.20	67.20	47.07	33.07	25.00	12.32	6.32	4.33	2.75
1.83V	132.27	65.07	45.87	32.53	24.51	12.05	6.19	4.24	2.69
1.85V	127.47	63.73	45.47	32.13	24.27	11.91	6.16	4.21	2.67
1.88V	122.13	62.40	44.93	31.73	24.15	11.80	6.11	4.17	2.65
1.90V	113.20	59.73	43.73	30.93	23.54	11.65	5.95	4.07	2.59

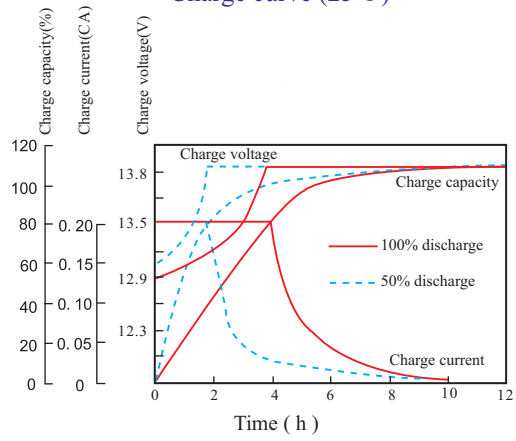
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hour	2hour	3hour	4hour	5hour	6hour	8hour	10hour
1.75V	769.1	549.3	302.1	178.5	137.3	109.9	93.4	82.4	64.5	54.9
1.80V	757.9	541.3	297.7	175.9	135.3	108.3	92.0	81.2	63.6	54.1
1.83V	742.9	530.7	291.9	172.5	132.7	106.1	90.2	79.6	62.4	53.1
1.85V	728.1	520.0	286.0	169.0	130.0	104.0	88.4	78.0	61.1	52.0
1.88V	709.3	506.7	278.7	164.7	126.7	101.3	86.1	76.0	59.5	50.7

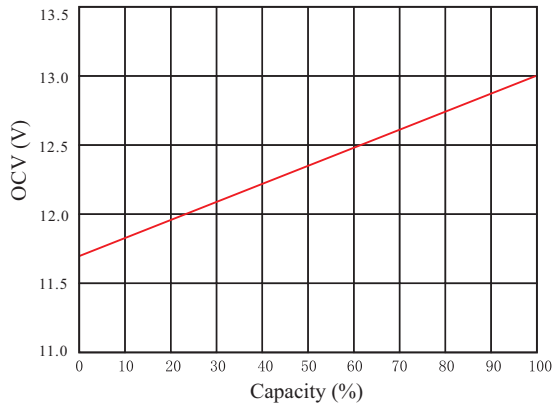
Discharge curve at different rate (25℃)



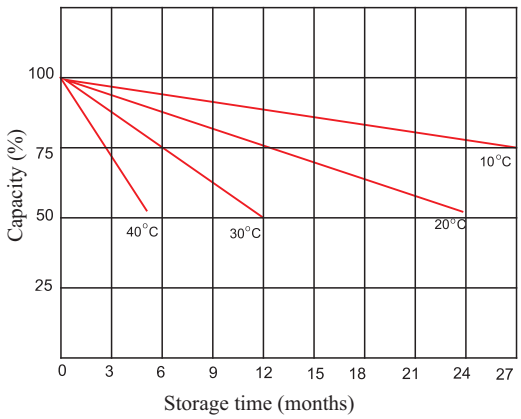
Charge curve (25℃)



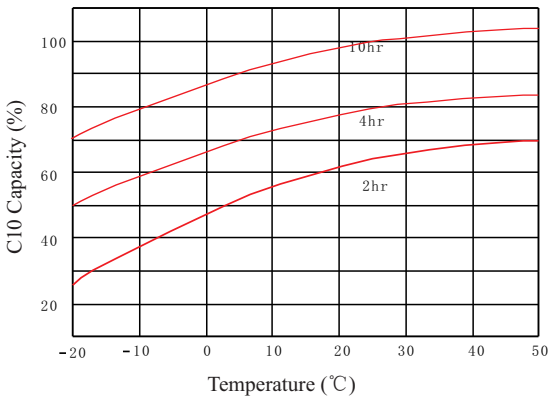
Capacity vs OCV curve



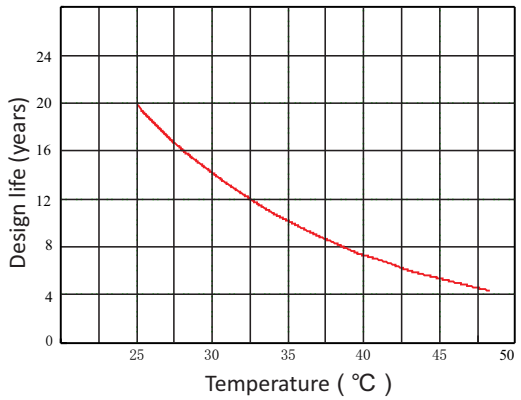
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature



Subject to revision without prior notice

6REXC300 -01-N-EN (ver 2.2-August.2015) Subject to revision without prior notice.E.&.O.E.

12REXC series

12REXC70

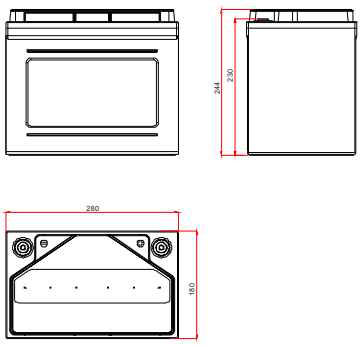
Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Home energy storage system
- Smart power grids and microgrid system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Dimension



Parameter

Nominal Voltage	12V
Capacity	70Ah (100hr to 1.85V/cell @25°C)
	60Ah (10hr to 1.80V/cell @25°C)
Typical Weight	30kg
Internal Resistance	Approx 9.79mΩ (acc. to IEC60896-21 clause 6.3)
Short-Circuit Current	1291A
Self Discharge	Residual capacity is above 90% after 90 days storage(25°C)
Temperature Ranges	Operation(recommended):15°C~25°C
	Operation(maximum):-20°C~50°C
Max. charging current	18A
Max. constant charging current	12A
Charge Voltage	Floating: 2.25V/cell(25°C)
	Equalizing/Cycle: 2.30V/cell(25°C)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N.m

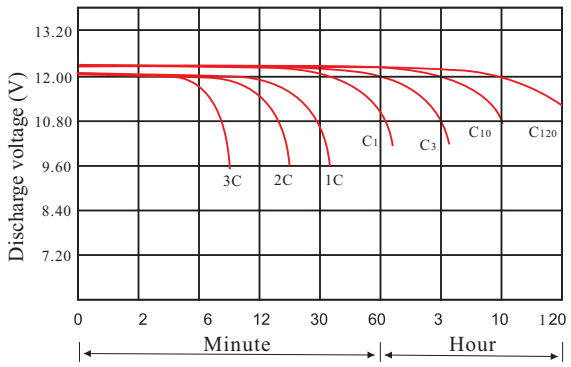
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	60min	3hour	5hour	8hour	10hour	24hour	48hour	72hour	120hour
1.75V	33.93	15.60	10.83	7.59	6.33	2.82	1.46	1.00	0.63
1.80V	31.77	15.12	10.59	7.44	6.18	2.77	1.42	0.98	0.62
1.83V	29.76	14.64	10.32	7.32	6.06	2.71	1.39	0.95	0.61
1.85V	28.68	14.34	10.23	7.23	6.00	2.68	1.39	0.95	0.60
1.88V	27.48	14.04	10.11	7.14	5.97	2.66	1.37	0.94	0.60
1.90V	25.47	13.44	9.84	6.96	5.82	2.62	1.34	0.92	0.58

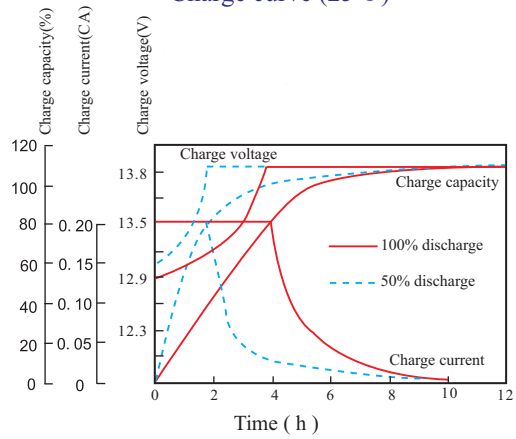
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hour	2hour	3hour	4hour	5hour	6hour	8hour	10hour
1.75V	148.11	111.78	68.52	44.91	32.07	26.31	22.35	19.23	14.73	12.36
1.80V	134.67	108.21	66.93	44.10	30.93	25.47	21.72	18.69	14.34	12.18
1.83V	127.53	102.66	64.53	42.30	30.18	25.08	21.27	18.12	14.07	11.94
1.85V	123.90	97.38	60.87	40.50	29.31	24.48	20.73	17.70	13.86	11.70
1.88V	111.45	91.29	57.21	37.65	28.29	23.64	20.04	17.07	13.50	11.40

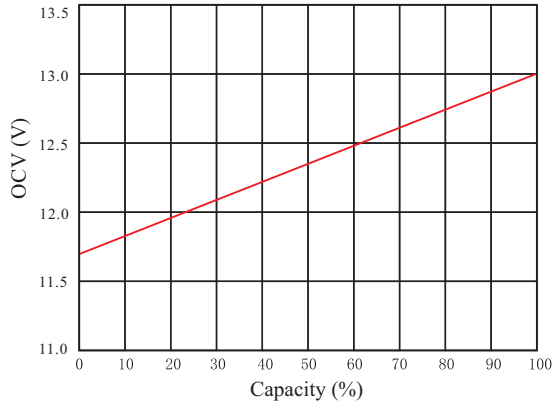
Discharge curve at different rate (25℃)



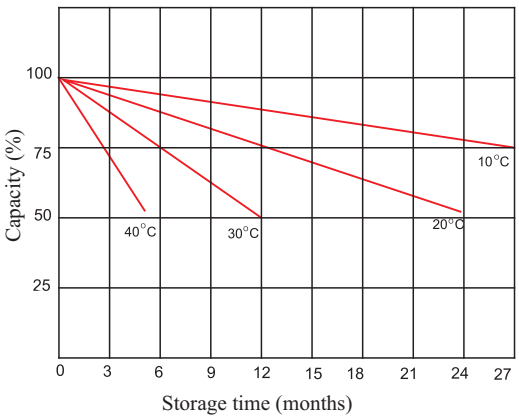
Charge curve (25℃)



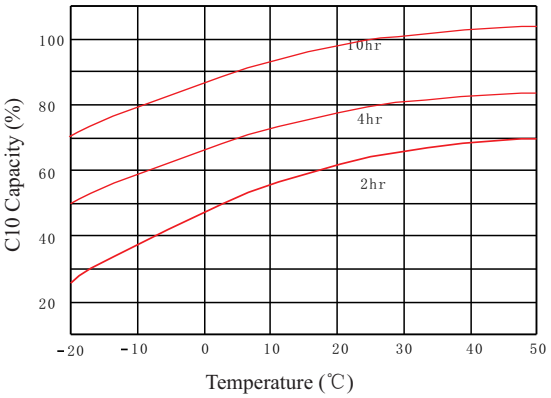
Capacity vs OCV curve



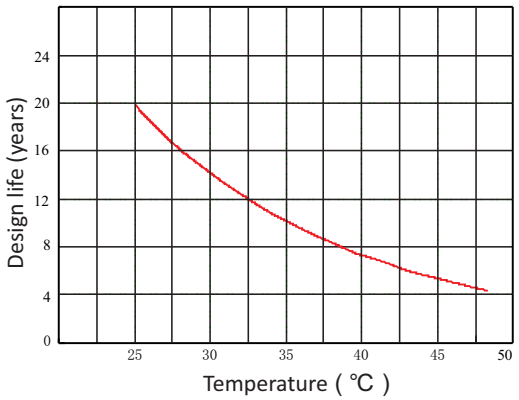
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature



Subject to revision without prior notice

12REXC70 -01-N-EN (ver 2.2-August.2015) Subject to revision without prior notice.E.&.O.E.

REXC series

12REXC120

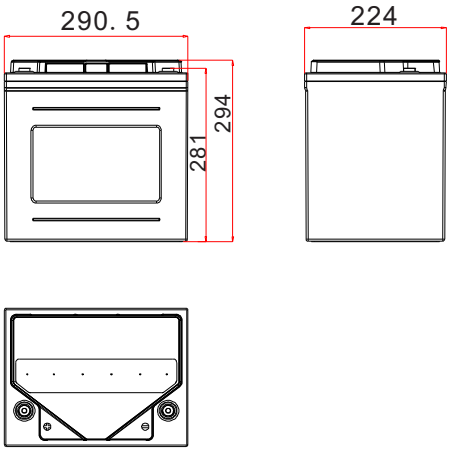
Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Home energy storage system
- Smart power grids and microgrid system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Dimension



Parameter

Nominal Voltage	12V
Capacity	120Ah (100hr to 1.85V/cell @25°C)
	100Ah (10hr to 1.80V/cell @25°C)
Typical Weight	51.0kg
Internal Resistance	Approx 3.20mΩ (acc. to IEC60896-21 clause 6.3)
Short-Circuit Current	1996A
Self Discharge	Residual capacity is above 90% after 90 days storage(25°C)
Temperature Ranges	Operation(recommended):15°C~25°C
	Operation(maximum):-20°C~50°C
Max. charging current	30A
Max. constant charging current	20A
Charge Voltage	Floating: 2.25V/cell(25°C)
	Equalizing/Cycle: 2.30V/cell(25°C)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N.m

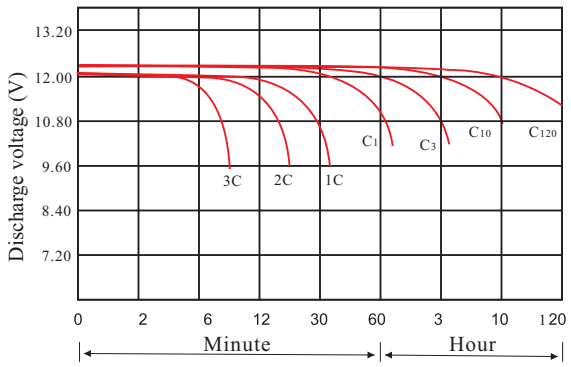
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	60min	3hour	5hour	8hour	10hour	24hour	48hour	72hour	120hour
1.75V	57.12	26.26	18.23	12.78	10.24	4.74	2.45	1.68	1.07
1.80V	53.48	25.45	17.83	12.53	10.00	4.67	2.39	1.64	1.04
1.83V	50.10	24.65	17.37	12.32	9.81	4.57	2.34	1.61	1.02
1.85V	48.28	24.14	17.22	12.17	9.71	4.51	2.33	1.60	1.01
1.88V	46.26	23.64	17.02	12.02	9.66	4.47	2.31	1.58	1.01
1.90V	42.88	22.63	16.57	11.72	9.42	4.41	2.25	1.54	0.98

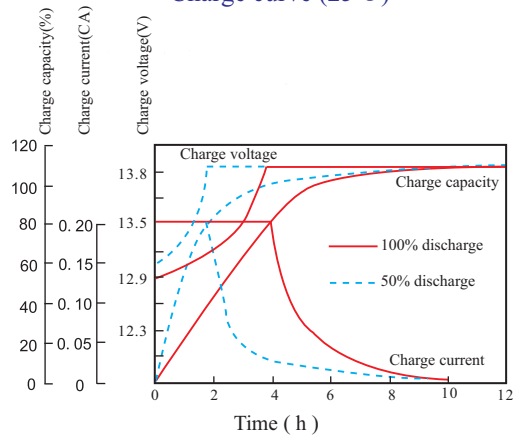
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hour	2hour	3hour	4hour	5hour	6hour	8hour	10hour
1.75V	249.3	188.2	115.4	75.6	54.0	44.3	37.6	32.4	24.8	20.81
1.80V	226.7	182.2	112.7	74.2	52.1	42.9	36.6	31.5	24.1	20.51
1.83V	214.7	172.8	108.6	71.2	50.8	42.2	35.8	30.5	23.7	20.10
1.85V	208.6	163.9	102.5	68.2	49.3	41.2	34.9	29.8	23.3	19.70
1.88V	187.6	153.7	96.3	63.4	47.6	39.8	33.7	28.7	22.7	19.19

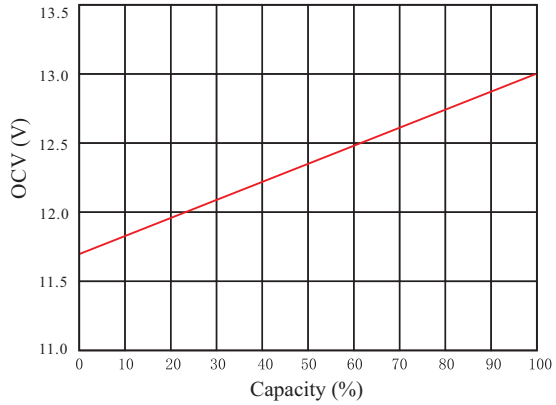
Discharge curve at different rate (25℃)



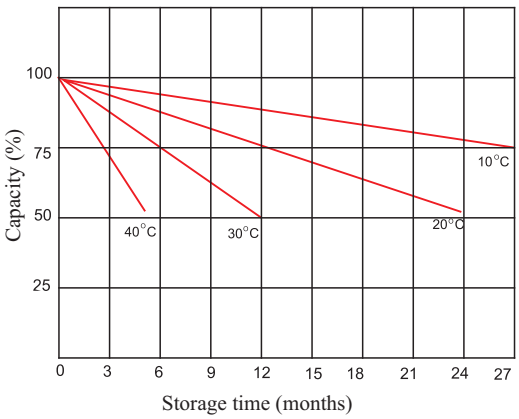
Charge curve (25℃)



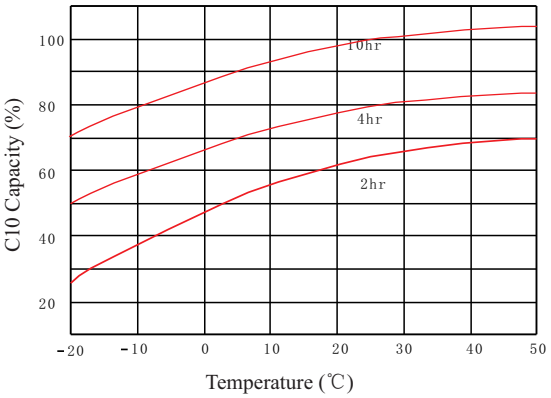
Capacity vs OCV curve



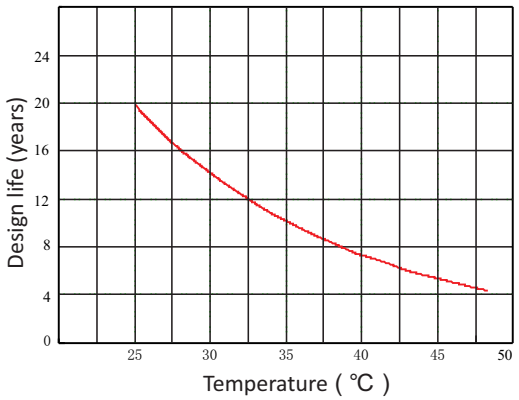
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature



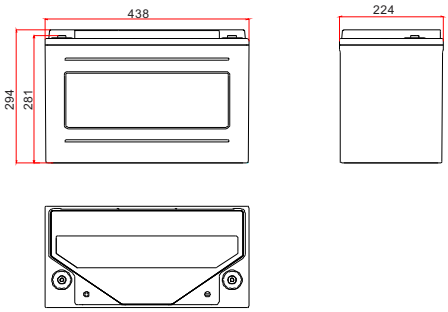
Subject to revision without prior notice

12REXC120 -01-N-EN (ver 1.0-February.2016) Subject to revision without prior notice.E.&.O.E.

12REXC series

12REXC200

Dimension



Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Home energy storage system
- Smart power grids and microgrid system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Parameter

Nominal Voltage	12V
Capacity	200Ah (100hr to 1.85V/cell @25°C)
	165Ah (10hr to 1.80V/cell @25°C)
Typical Weight	79.5kg
Internal Resistance	Approx 3.83mΩ (acc. to IEC60896-21 clause 6.3)
Short-Circuit Current	3274A
Self Discharge	Residual capacity is above 90% after 90 days storage(25°C)
Temperature Ranges	Operation(recommended):15°C~25°C
	Operation(maximum):-20°C~50°C
Max. charging current	49.5A
Max. constant charging current	33A
Charge Voltage	Floating: 2.25V/cell(25°C)
	Equalizing/Cycle: 2.30V/cell(25°C)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N.m

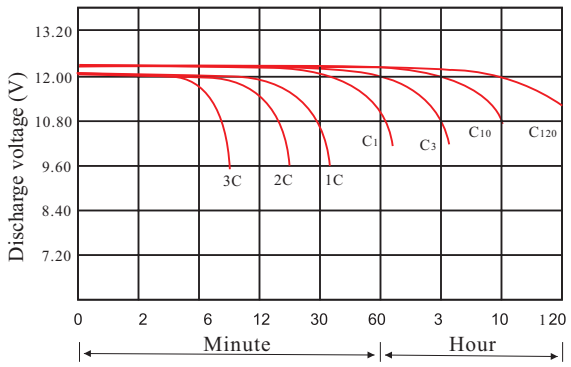
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	60min	3hour	5hour	8hour	10hour	24hour	48hour	72hour	120hour
1.75V	94.25	43.33	30.08	21.08	17.58	7.83	4.04	2.77	1.76
1.80V	88.25	42.00	29.42	20.67	17.17	7.70	3.95	2.71	1.72
1.83V	82.67	40.67	28.67	20.33	16.83	7.53	3.87	2.65	1.68
1.85V	79.67	39.83	28.42	20.08	16.67	7.44	3.85	2.63	1.67
1.88V	76.33	39.00	28.08	19.83	16.58	7.38	3.82	2.61	1.66
1.90V	70.75	37.33	27.33	19.33	16.17	7.28	3.72	2.54	1.62

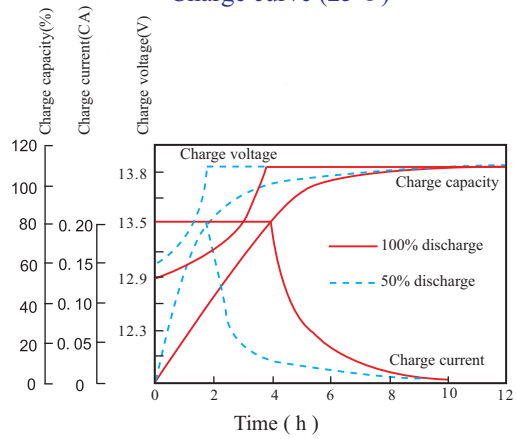
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hour	2hour	3hour	4hour	5hour	6hour	8hour	10hour
1.75V	411.4	310.5	190.3	124.8	89.1	73.1	62.1	53.4	40.9	34.3
1.80V	374.1	300.6	185.9	122.5	85.9	70.8	60.3	51.9	39.8	33.8
1.83V	354.3	285.2	179.3	117.5	83.8	69.7	59.1	50.3	39.1	33.2
1.85V	344.2	270.5	169.1	112.5	81.4	68.0	57.6	49.2	38.5	32.5
1.88V	309.6	253.6	158.9	104.6	78.6	65.7	55.7	47.4	37.5	31.7

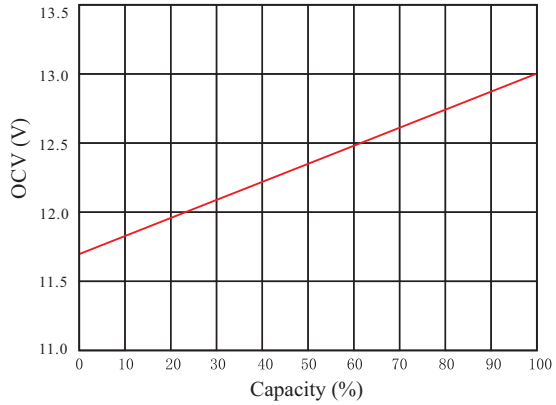
Discharge curve at different rate (25℃)



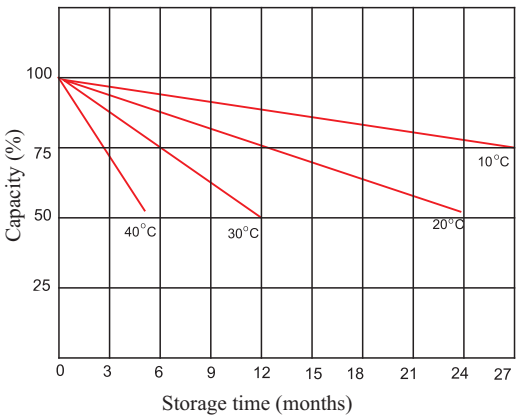
Charge curve (25℃)



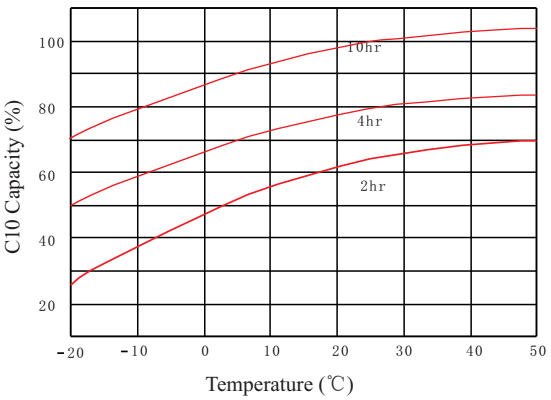
Capacity vs OCV curve



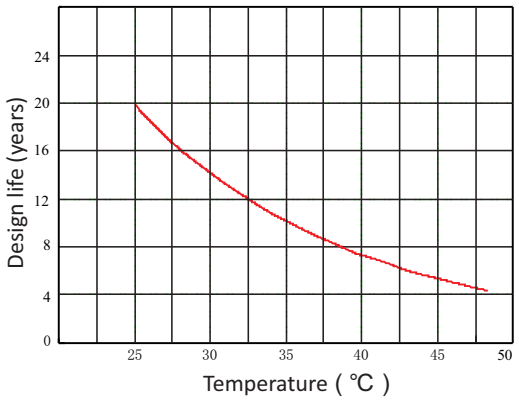
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature



Subject to revision without prior notice

12REXC200 -01-N-EN (ver 2.2-August.2015) Subject to revision without prior notice.E.&.O.E.

REXC series

12REXC120

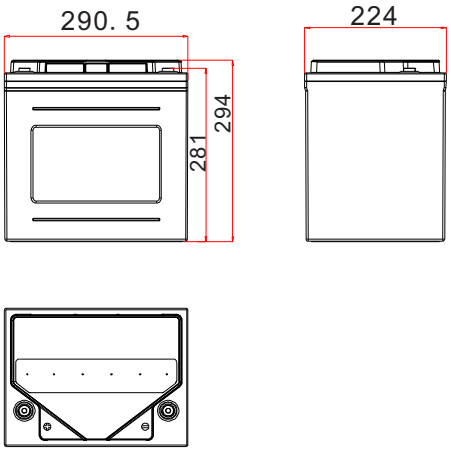
Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Home energy storage system
- Smart power grids and microgrid system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Dimension



Parameter

Nominal Voltage	12V
Capacity	120Ah (100hr to 1.85V/cell @25°C)
	100Ah (10hr to 1.80V/cell @25°C)
Typical Weight	51.0kg
Internal Resistance	Approx 3.20mΩ (acc. to IEC60896-21 clause 6.3)
Short-Circuit Current	1996A
Self Discharge	Residual capacity is above 90% after 90 days storage(25°C)
Temperature Ranges	Operation(recommended):15°C~25°C
	Operation(maximum):-20°C~50°C
Max. charging current	30A
Max. constant charging current	20A
Charge Voltage	Floating: 2.25V/cell(25°C)
	Equalizing/Cycle: 2.30V/cell(25°C)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N.m

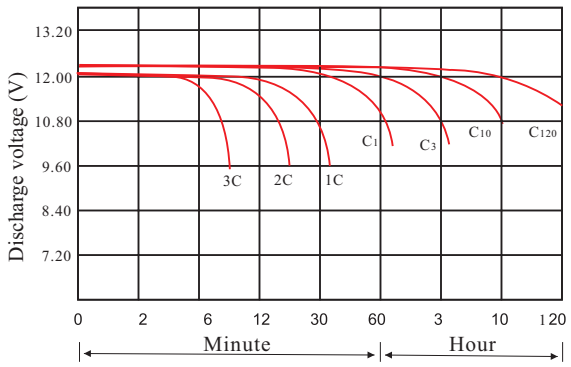
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	60min	3hour	5hour	8hour	10hour	24hour	48hour	72hour	120hour
1.75V	57.12	26.26	18.23	12.78	10.24	4.74	2.45	1.68	1.07
1.80V	53.48	25.45	17.83	12.53	10.00	4.67	2.39	1.64	1.04
1.83V	50.10	24.65	17.37	12.32	9.81	4.57	2.34	1.61	1.02
1.85V	48.28	24.14	17.22	12.17	9.71	4.51	2.33	1.60	1.01
1.88V	46.26	23.64	17.02	12.02	9.66	4.47	2.31	1.58	1.01
1.90V	42.88	22.63	16.57	11.72	9.42	4.41	2.25	1.54	0.98

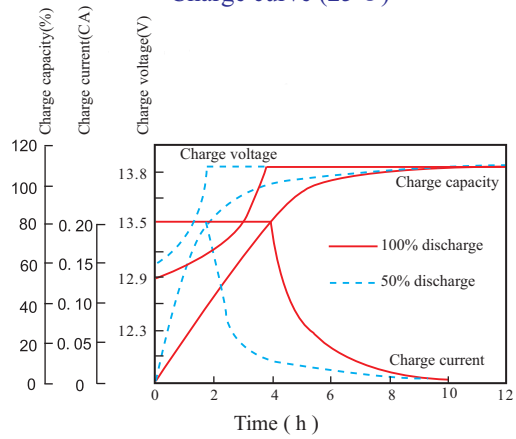
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hour	2hour	3hour	4hour	5hour	6hour	8hour	10hour
1.75V	249.3	188.2	115.4	75.6	54.0	44.3	37.6	32.4	24.8	20.81
1.80V	226.7	182.2	112.7	74.2	52.1	42.9	36.6	31.5	24.1	20.51
1.83V	214.7	172.8	108.6	71.2	50.8	42.2	35.8	30.5	23.7	20.10
1.85V	208.6	163.9	102.5	68.2	49.3	41.2	34.9	29.8	23.3	19.70
1.88V	187.6	153.7	96.3	63.4	47.6	39.8	33.7	28.7	22.7	19.19

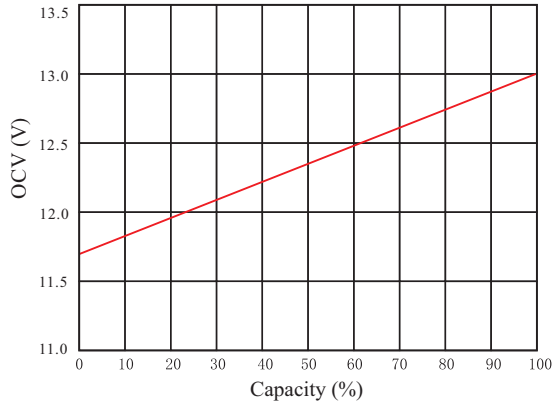
Discharge curve at different rate (25℃)



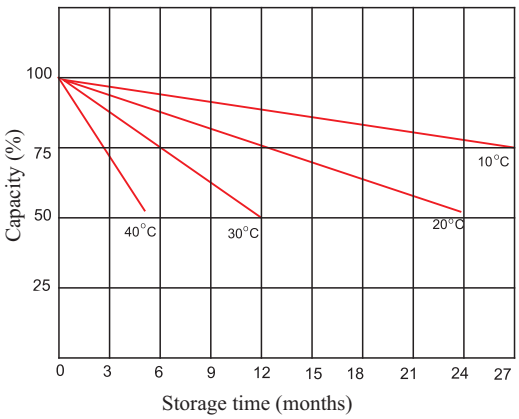
Charge curve (25℃)



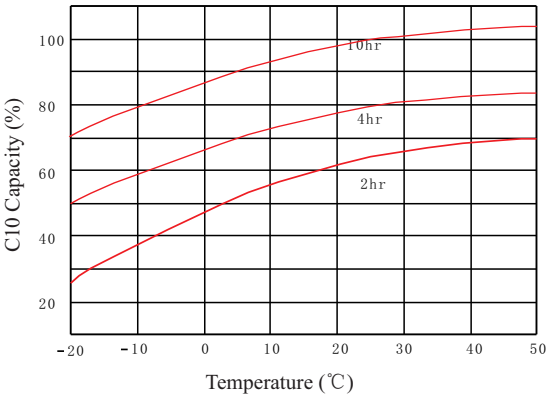
Capacity vs OCV curve



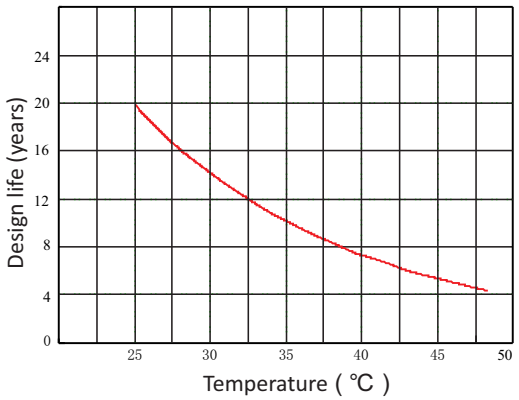
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature



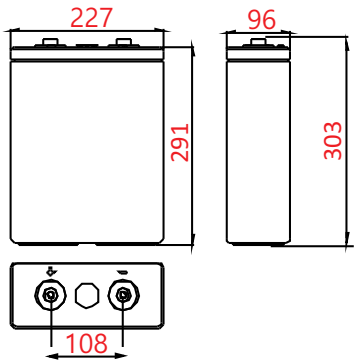
Subject to revision without prior notice

12REXC120 -01-N-EN (ver 1.0-February.2016) Subject to revision without prior notice.E.&.O.E.

REXC series

REXC-200

Dimension (mm)



Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Renewable energy storage
- Smart power grids and microgrids system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Home energy storage system
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Parameter

Nominal Voltage	2V
Capacity	200Ah (10hr to 1.80V/cell @25℃) 240Ah (120hr to 1.85V/cell @25℃)
Typical Weight	17kg
Internal Resistance	Approx 0.55mΩ
Short-Circuit Current	3700A
Self Discharge	The residual capacity is above 90% after 90 days storage (25℃)
Temperature Ranges	Operation(recommended):15℃~25℃ Operation(maximum):-40℃~50℃
Max. charging current	60A
Max. constant charging current	40A
Charge Voltage	Floating:2.25V (25℃) Equalizing/Cycle: 2. 30V(25℃)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N·m

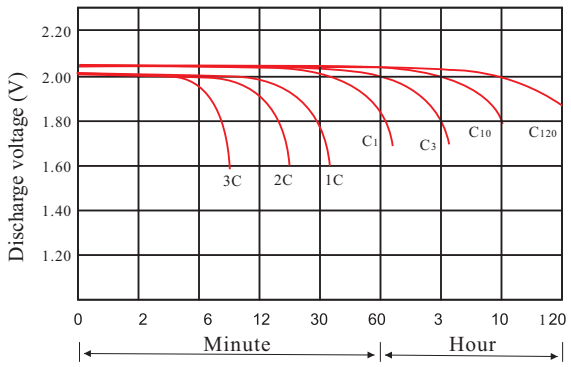
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	1hr	3hr	5hr	8hr	10hr	24hr	48hr	72hr	120hr
1.75V	113.1	52.0	36.1	25.3	21.1	9.40	4.90	3.30	2.10
1.80V	105.9	50.4	35.3	24.8	20.6	9.20	4.70	3.30	2.10
1.83V	99.2	48.8	34.4	24.4	20.2	9.00	4.60	3.20	2.00
1.85V	95.6	47.8	34.1	24.1	20.0	8.90	4.60	3.20	2.00
1.88V	91.6	46.8	33.7	23.8	19.9	8.90	4.60	3.10	1.90

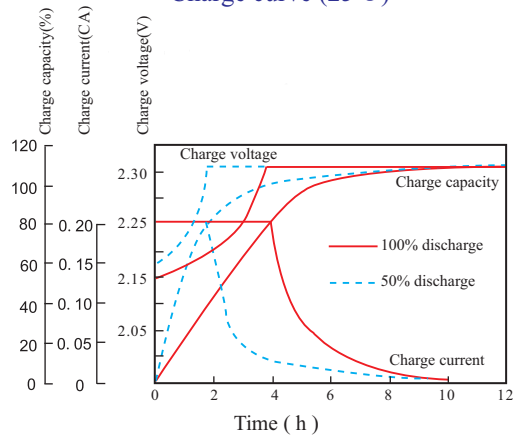
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hr	2hr	3hr	4hr	5hr	6hr	8hr	10hr
1.75V	493.7	372.6	228.4	149.7	106.9	87.7	74.5	64.1	49.1	41.2
1.80V	448.9	360.7	223.1	147.0	103.1	84.9	72.4	62.3	47.8	40.6
1.83V	425.1	342.2	215.1	141.0	100.6	83.6	70.9	60.4	46.9	39.8
1.85V	413.0	324.6	202.9	135.0	97.7	81.6	69.1	59.0	46.2	39.0
1.88V	371.5	304.3	190.7	125.5	94.3	78.8	66.8	56.9	45.0	38.0

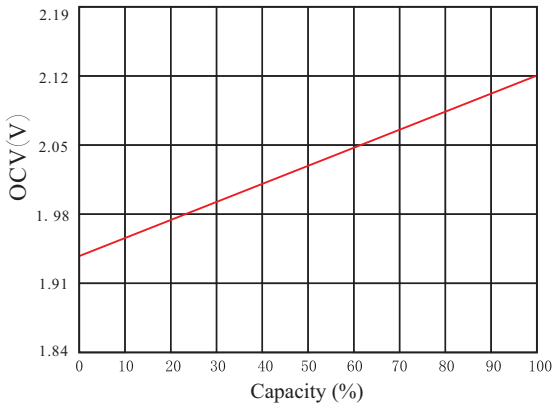
Discharge curve at different rate (25℃)



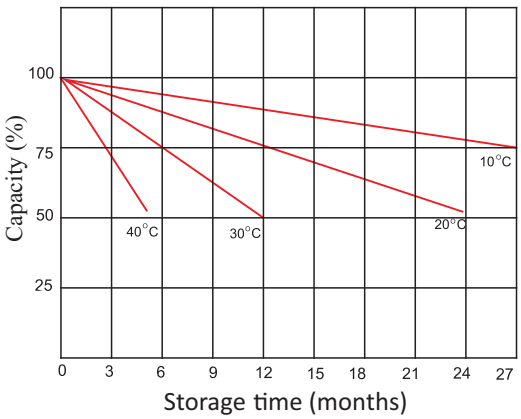
Charge curve (25℃)



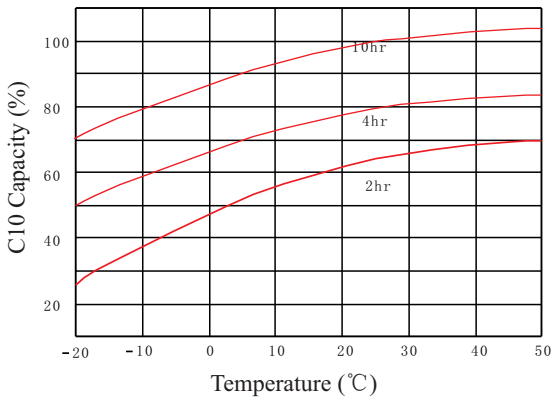
Capacity vs OCV curve



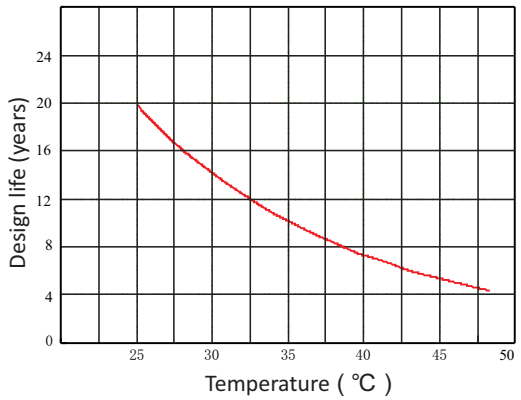
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature



Subject to revision without prior notice

REXC-200 -01-N-EN (ver 1.2-Oct.2015) Subject to revision without prior notice.E.&.O.E.

REXC series

REXC-300

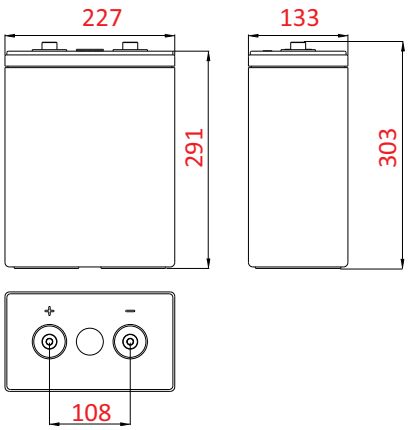
Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Renewable energy storage
- Smart power grids and microgrids system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Home energy storage system
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Dimension (mm)



Parameter

Nominal Voltage	2V
Capacity	300Ah (10hr to 1.80V/cell @25℃) 360Ah (120hr to 1.85V/cell @25℃)
Typical Weight	24kg
Internal Resistance	Approx 0.39mΩ
Short-Circuit Current	4752A
Self Discharge	The residual capacity is above 90% after 90 days storage (25℃)
Temperature Ranges	Operation(recommended):15℃~25℃ Operation(maximum):-40℃~50℃
Max. charging current	90A
Max. constant charging current	60A
Charge Voltage	Floating:2.25V (25℃) Equalizing/Cycle: 2. 30V(25℃)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N·m

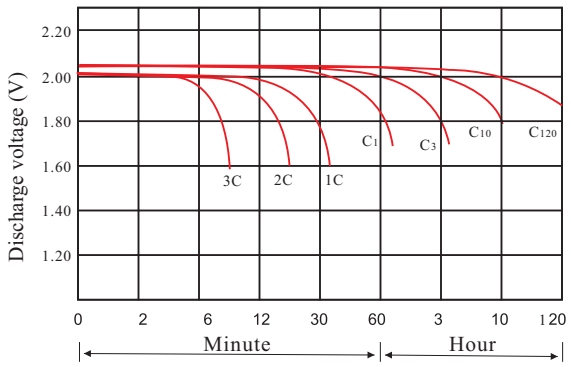
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	1hr	3hr	5hr	8hr	10hr	24hr	48hr	72hr	120hr
1.75V	169.6	78.0	54.2	37.9	31.6	14.1	7.30	5.00	3.20
1.80V	158.9	75.6	52.9	37.2	30.9	13.9	7.10	4.90	3.10
1.83V	148.8	73.1	51.7	36.5	30.2	13.6	7.00	4.80	3.00
1.85V	143.4	71.7	51.1	36.1	30.1	13.4	6.90	4.70	3.00
1.88V	137.4	70.2	50.6	35.7	29.8	13.3	6.90	4.60	3.00

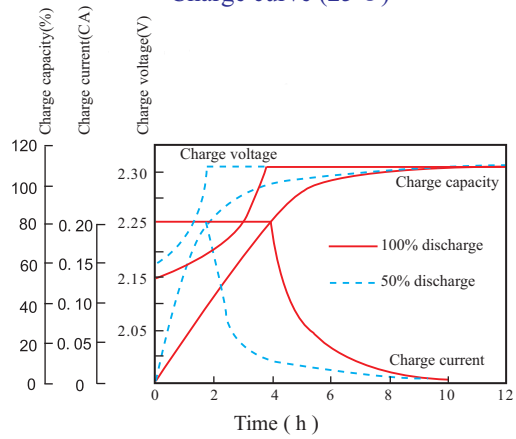
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hr	2hr	3hr	4hr	5hr	6hr	8hr	10hr
1.75V	740.1	546.4	342.6	224.6	160.4	131.6	111.8	96.2	73.6	61.8
1.80V	686.1	528.5	334.6	220.4	154.7	127.3	108.7	93.4	71.7	60.8
1.83V	653.4	500.7	322.7	211.5	150.9	125.5	106.4	90.6	70.3	59.7
1.85V	632.1	474.4	304.3	202.6	146.5	122.4	103.6	88.4	69.3	58.5
1.88V	556.7	443.9	286.0	188.3	141.5	118.2	100.2	85.3	67.4	57.1

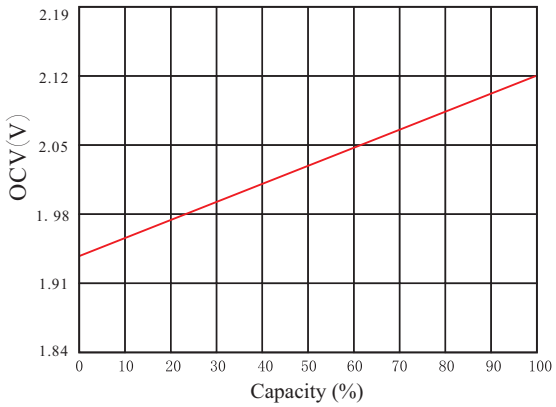
Discharge curve at different rate (25℃)



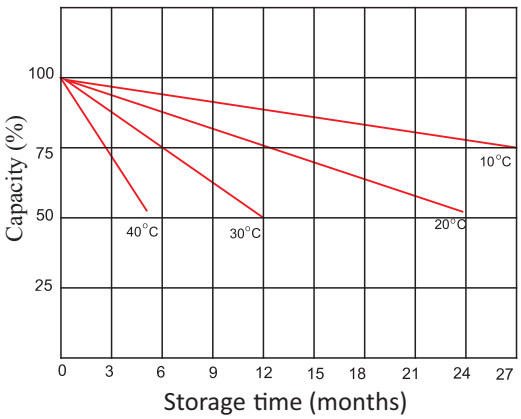
Charge curve (25℃)



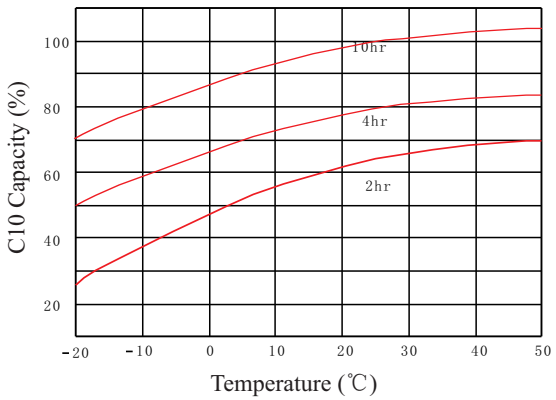
Capacity vs OCV curve



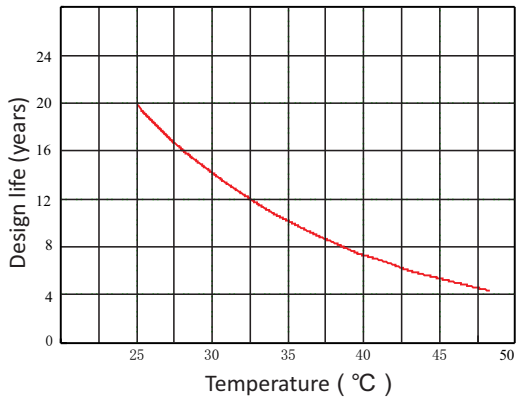
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature



Subject to revision without prior notice

REXC-300 -01-N-EN (ver 1.2-Oct.2015) Subject to revision without prior notice.E.&.O.E.

REXC series

REXC-400

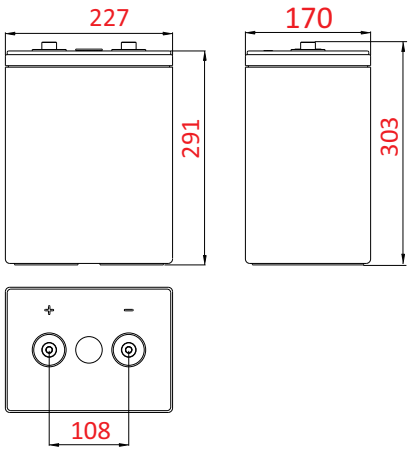
Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Renewable energy storage
- Smart power grids and microgrids system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Home energy storage system
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Dimension (mm)



Parameter

Nominal Voltage	2V
Capacity	400Ah (10hr to 1.80V/cell @25℃) 480Ah (120hr to 1.85V/cell @25℃)
Typical Weight	32kg
Internal Resistance	Approx 0.30mΩ
Short-Circuit Current	6107A
Self Discharge	The residual capacity is above 90% after 90 days storage (25℃)
Temperature Ranges	Operation(recommended):15℃~25℃ Operation(maximum):-40℃~50℃
Max. charging current	120A
Max. constant charging current	80A
Charge Voltage	Floating:2.25V (25℃) Equalizing/Cycle: 2. 30V(25℃)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N·m

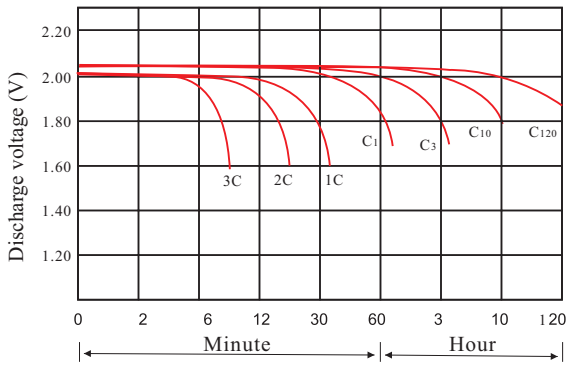
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	1hr	3hr	5hr	8hr	10hr	24hr	48hr	72hr	120hr
1.75V	226.2	104.0	72.2	50.6	42.1	18.8	9.70	6.60	4.20
1.80V	211.9	100.8	70.5	49.6	41.2	18.5	9.50	6.50	4.10
1.83V	198.4	97.5	68.9	48.7	40.3	18.1	9.30	6.40	4.00
1.85V	191.3	95.6	68.2	48.2	40.1	17.9	9.20	6.30	4.00
1.88V	183.2	93.6	67.5	47.6	39.8	17.7	9.20	6.10	4.00

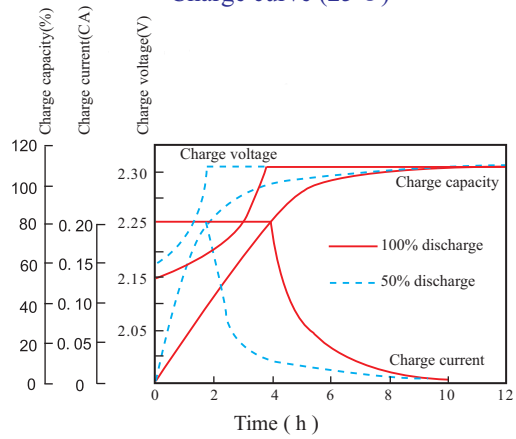
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hr	2hr	3hr	4hr	5hr	6hr	8hr	10hr
1.75V	986.5	717.2	456.8	299.5	231.8	175.5	149.0	128.3	98.1	82.4
1.80V	922.9	693.4	446.2	293.9	206.3	169.8	144.9	124.5	95.6	81.1
1.83V	886.5	656.3	430.3	282.2	201.2	167.3	141.9	120.7	93.7	79.6
1.85V	843.9	621.2	405.8	270.1	195.3	163.3	138.1	117.9	92.4	78.0
1.88V	636.9	580.6	381.3	251.0	188.7	157.7	133.6	113.7	89.9	76.1

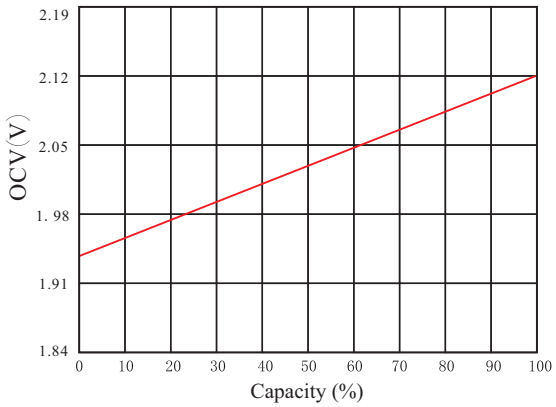
Discharge curve at different rate (25℃)



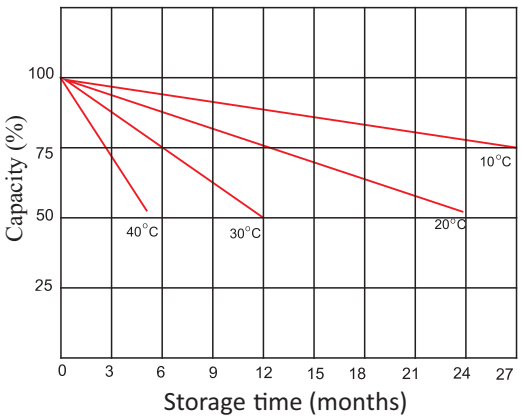
Charge curve (25℃)



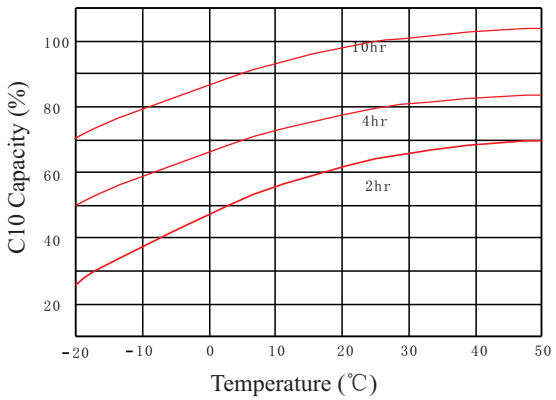
Capacity vs OCV curve



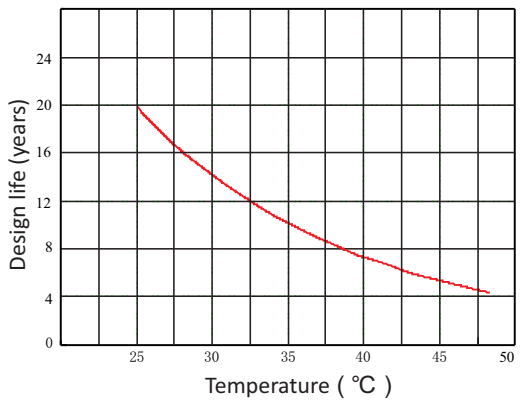
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature



Subject to revision without prior notice

REXC-400 -01-N-EN (ver 1.2-Oct.2015) Subject to revision without prior notice.E.&.O.E.

REXC series

REXC-500

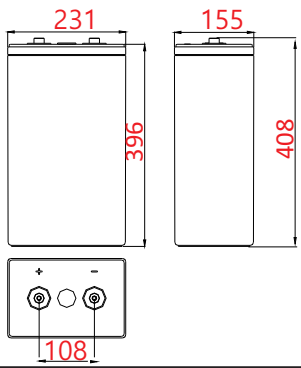
Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Renewable energy storage
- Smart power grids and microgrids system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Home energy storage system
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Dimension (mm)



Parameter

Nominal Voltage	2V
Capacity	500Ah (10hr to 1.80V/cell @25℃) 600Ah (120hr to 1.85V/cell @25℃)
Typical Weight	39kg
Internal Resistance	Approx 0.28mΩ
Short-Circuit Current	7211A
Self Discharge	Residual capacity is above 90% after 90 days storage (25℃)
Temperature Ranges	Operation(recommended):15℃~25℃ Operation(maximum):-40℃~50℃
Max. charging current	150A
Max. constant charging current	100A
Charge Voltage	Floating:2.25V (25℃) Equalizing/Cycle: 2. 30V (25℃)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N·m

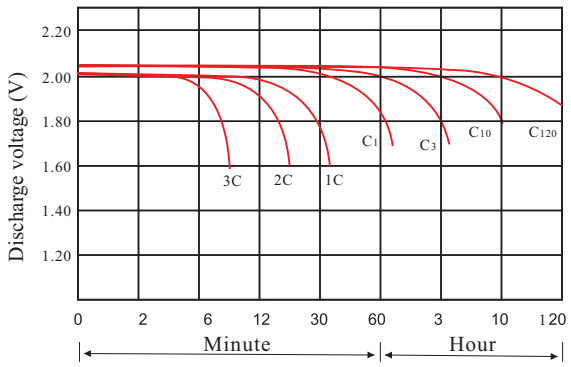
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	1hr	3hr	5hr	8hr	10hr	24hr	48hr	72hr	120hr
1.75V	282.7	129.9	90.3	63.2	52.7	23.5	12.1	8.30	5.30
1.80V	264.9	126.0	88.2	62.0	51.5	23.1	11.9	8.10	5.20
1.83V	248.0	121.9	86.1	60.9	50.4	22.6	11.6	7.90	5.10
1.85V	239.1	119.5	85.2	60.2	50.1	22.3	11.5	7.90	5.00
1.88V	229.0	117.1	84.3	59.5	49.7	22.1	11.4	7.80	4.90

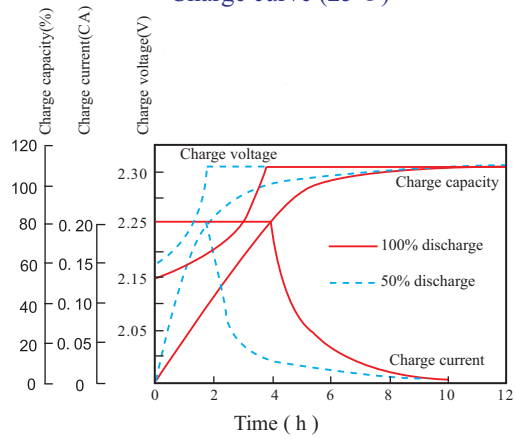
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hr	2hr	3hr	4hr	5hr	6hr	8hr	10hr
1.75V	1233	894.0	571.0	374.3	267.3	219.3	186.3	160.4	122.6	103.0
1.80V	1160	864.2	557.7	367.4	257.8	212.2	181.1	155.6	119.5	101.4
1.83V	1092	817.9	537.9	352.5	251.6	209.1	177.3	150.9	117.1	99.4
1.85V	1020	774.0	507.2	337.6	244.2	204.1	172.6	147.4	115.6	97.5
1.88V	948	733.2	476.6	313.8	235.8	197.1	167.0	142.1	112.4	95.1

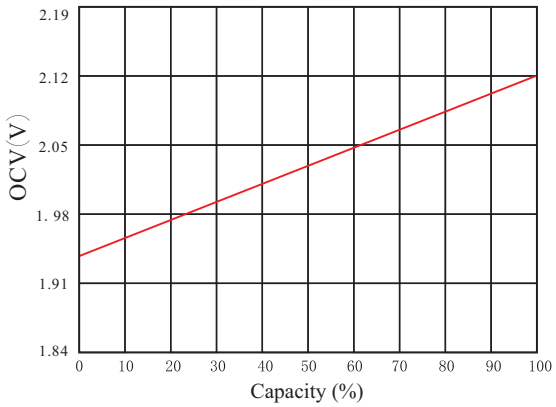
Discharge curve at different rate (25℃)



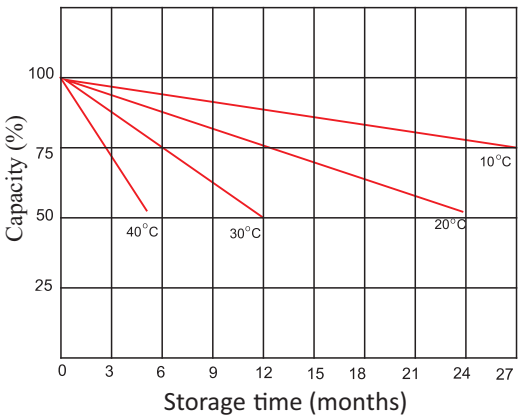
Charge curve (25℃)



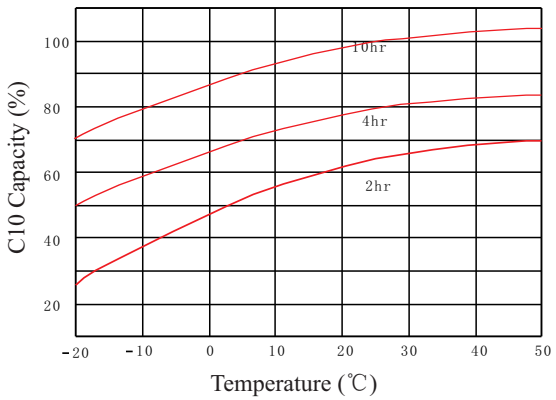
Capacity vs OCV curve



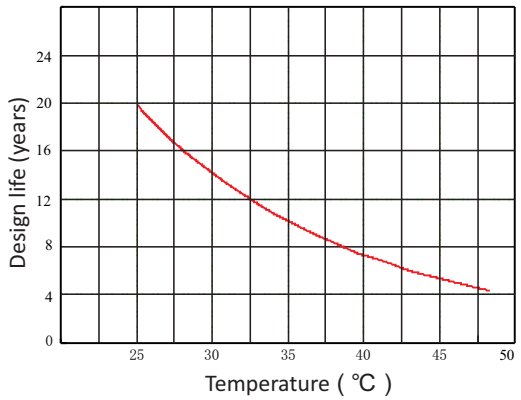
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature

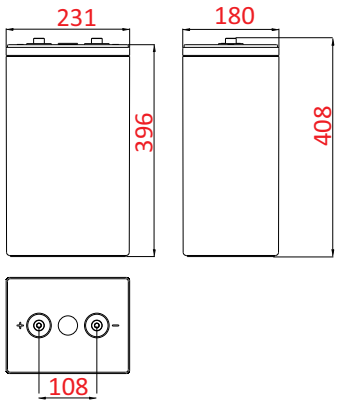


Subject to revision without prior notice

REXC-500 -01-N-EN (ver 1.2-Oct.2015) Subject to revision without prior notice.E.&.O.E.

REXC series

REXC-600



Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Renewable energy storage
- Smart power grids and microgrids system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Home energy storage system
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Parameter

Nominal Voltage	2V
Capacity	600Ah (10hr to 1.80V/cell @25℃)
	720Ah (120hr to 1.85V/cell @25℃)
Typical Weight	46kg
Internal Resistance	Approx 0.23mΩ
Short-Circuit Current	8614A
Self Discharge	The residual capacity is above 90% after 90 days storage (25℃)
Temperature Ranges	Operation(recommended):15℃~25℃
	Operation(maximum):-40℃~50℃
Max. charging current	180A
Max. constant charging current	120A
Charge Voltage	Floating:2.25V (25℃)
	Equalizing/Cycle: 2.30V(25℃)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N·m

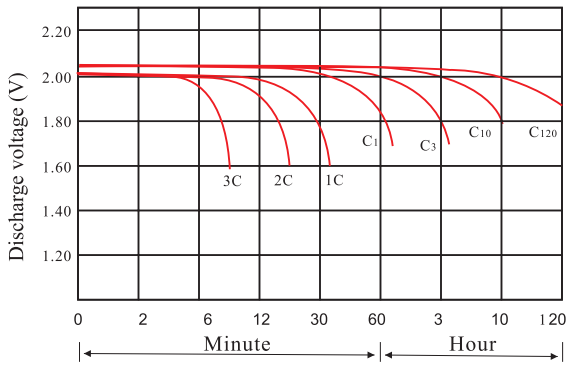
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	1hr	3hr	5hr	8hr	10hr	24hr	48hr	72hr	120hr
1.75V	339.3	155.9	108.3	75.8	63.2	28.2	14.6	10.0	6.30
1.80V	317.8	151.2	105.8	74.4	61.8	27.7	14.2	9.70	6.20
1.83V	297.6	146.3	103.3	73.1	60.5	27.1	13.9	9.50	6.10
1.85V	286.9	143.4	102.3	72.3	60.1	26.8	13.8	9.50	6.00
1.88V	274.8	140.5	101.2	71.4	59.6	26.6	13.7	9.40	5.90

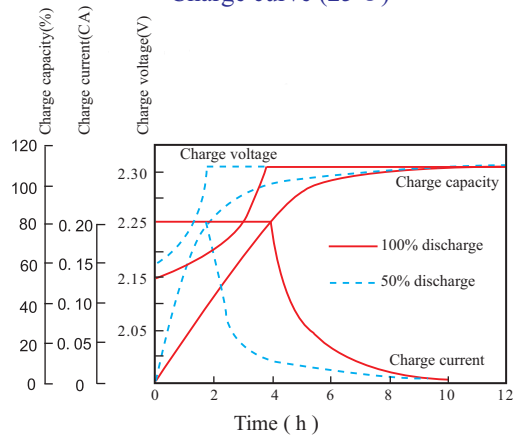
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hr	2hr	3hr	4hr	5hr	6hr	8hr	10hr
1.75V	1480	1033.1	698.8	453.7	323.9	263.2	223.6	192.4	147.2	123.6
1.80V	1392	996.6	682.7	445.3	312.5	254.7	217.3	186.8	143.4	121.7
1.83V	1311	939.9	658.3	427.2	304.9	250.9	212.8	181.1	140.6	119.3
1.85V	1224	886.2	620.9	409.2	295.9	244.9	207.2	176.9	138.7	117.0
1.88V	1138	824.1	583.4	380.3	285.8	236.5	200.4	170.6	134.9	114.1

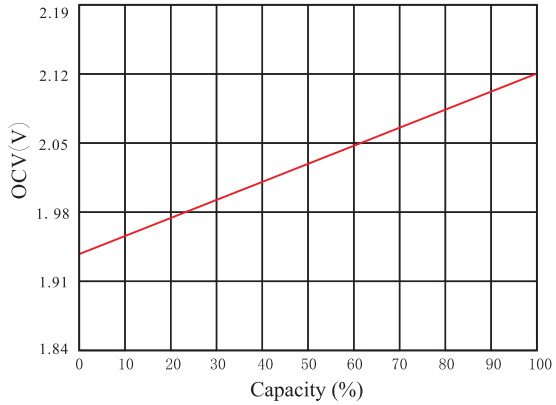
Discharge curve at different rate (25℃)



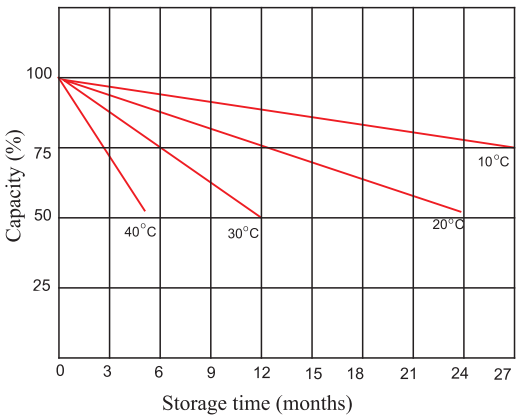
Charge curve (25℃)



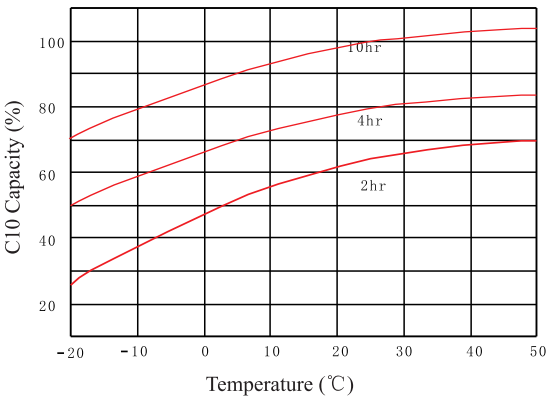
Capacity vs OCV curve



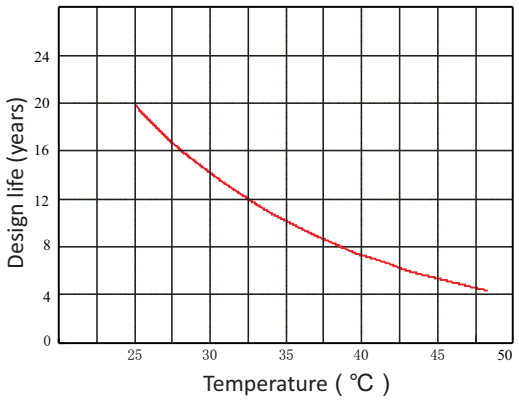
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature

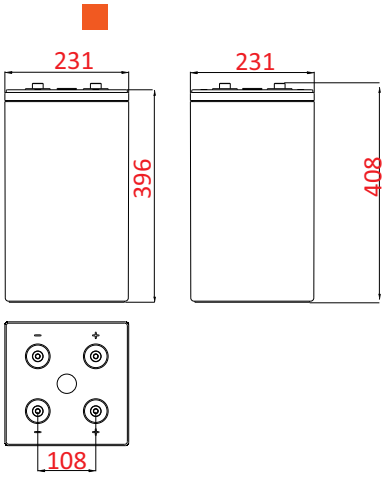


Subject to revision without prior notice

REXC-600 -01-N-EN (ver 1.2-Oct.2015) Subject to revision without prior notice.E.&.O.E.

REXC series

REXC-800



Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Renewable energy storage
- Smart power grids and microgrids system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Home energy storage system
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Parameter

Nominal Voltage	2V
Capacity	800Ah (10hr to 1.80V/cell @25℃) 960Ah (120hr to 1.85V/cell @25℃)
Typical Weight	60kg
Internal Resistance	Approx 0.18mΩ
Short-Circuit Current	10873A
Self Discharge	The residual capacity is above 90% after 90 days storage (25℃)
Temperature Ranges	Operation(recommended):15℃~25℃ Operation(maximum):-40℃~50℃
Max. charging current	240A
Max. constant charging current	160A
Charge Voltage	Floating:2.25V (25℃) Equalizing/Cycle : 2.30V(25℃)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N·m

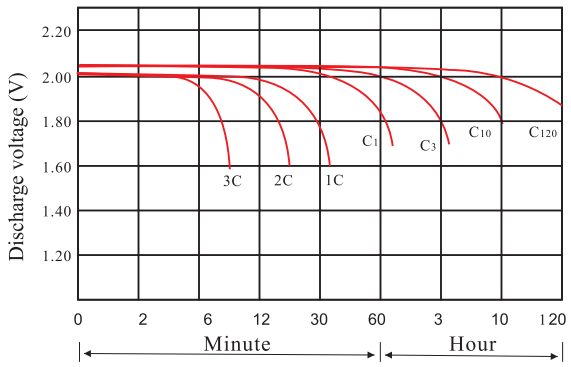
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	1hr	3hr	5hr	8hr	10hr	24hr	48hr	72hr	120hr
1.75V	442.8	214.3	146.0	100.3	83.6	37.7	19.3	13.2	8.40
1.80V	420.6	209.5	142.7	98.4	82.5	36.9	19.0	13.0	8.30
1.83V	396.8	203.2	140.5	97.8	82.1	36.9	18.9	12.9	8.20
1.85V	371.4	192.2	133.7	94.4	79.2	35.8	18.2	12.5	8.00
1.88V	337.3	181.2	127.4	91.0	76.2	34.8	17.6	12.0	7.60

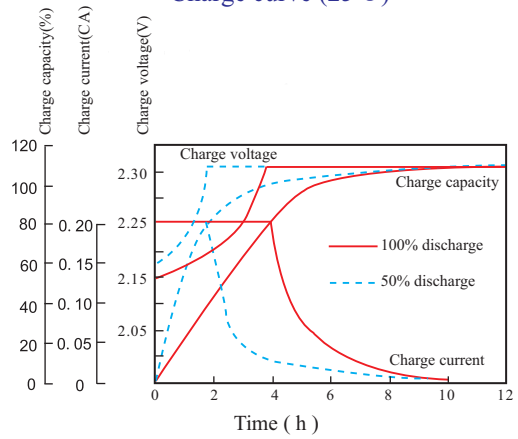
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hr	2hr	3hr	4hr	5hr	6hr	8hr	10hr
1.75V	1973	1224.5	897.8	566.4	446.9	357.5	301.9	262.1	216.9	182.7
1.80V	1856	1144.5	826.5	545.6	433.3	351.9	293.9	256.6	212.1	179.5
1.83V	1748	1069.6	773.0	525.5	423.6	342.4	286.0	249.4	206.5	176.4
1.85V	1632	988.5	708.2	505.5	409.2	332.8	278.0	242.3	200.0	170.0
1.88V	1517	891.3	648.2	479.8	386.7	319.3	270.1	236.7	194.6	165.2

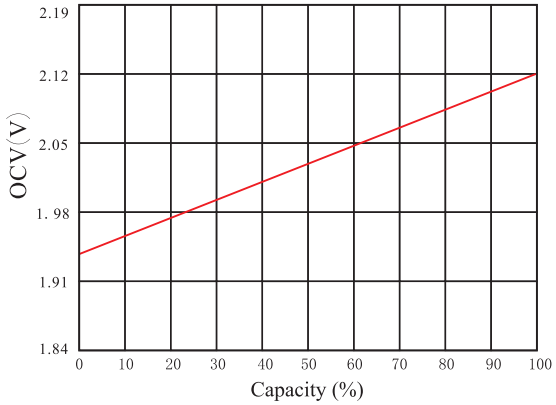
Discharge curve at different rate (25℃)



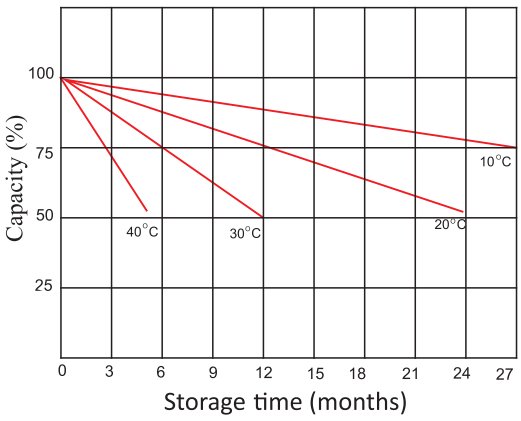
Charge curve (25℃)



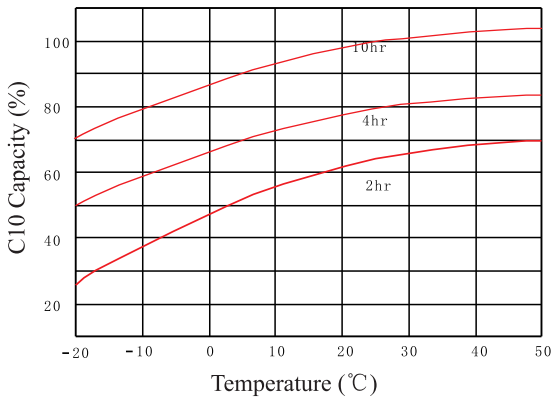
Capacity vs OCV curve



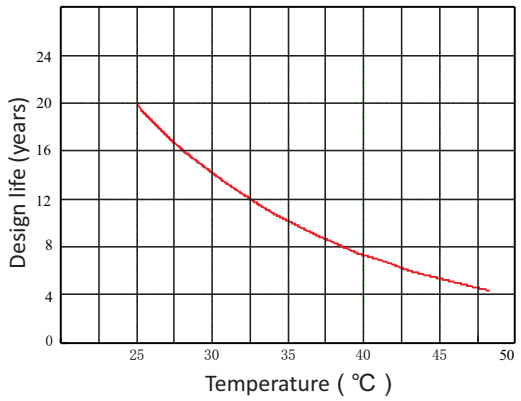
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature



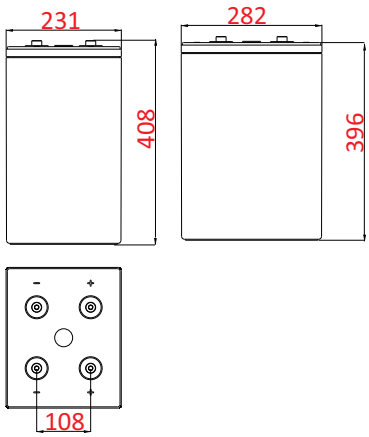
Subject to revision without prior notice

REXC-800 -01-N-EN (ver 1.2-Oct.2015) Subject to revision without prior notice.E.&.O.E.

REXC series

REXC-1000

Dimension (mm)



Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Renewable energy storage
- Smart power grids and microgrids system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Home energy storage system
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Parameter

Nominal Voltage	2V
Capacity	1000Ah (10hr to 1.80V/cell @25℃)
	1200Ah (120hr to 1.85V/cell @25℃)
Typical Weight	75kg
Internal Resistance	Approx 0.15mΩ
Short-Circuit Current	12835A
Self Discharge	The residual capacity is above 90% after 90 days storage (25℃)
Temperature Ranges	Operation(recommended):15℃~25℃
	Operation(maximum):-40℃~50℃
Max. charging current	300A
Max. constant charging current	200A
Charge Voltage	Floating:2.25V (25℃)
	Equalizing/Cycle : 2. 30V(25℃)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N·m

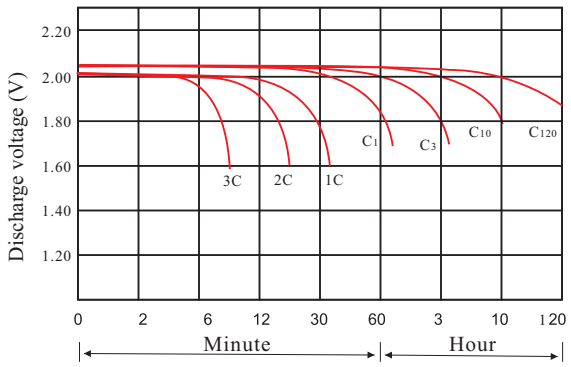
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	1hr	3hr	5hr	8hr	10hr	24hr	48hr	72hr	120hr
1.75V	553.5	267.8	182.5	125.4	104.6	47.1	24.1	16.5	10.5
1.80V	525.7	261.9	178.4	123.0	103.2	46.1	23.8	16.3	10.3
1.83V	496.0	253.9	175.6	122.3	102.7	46.1	23.7	16.2	10.3
1.85V	464.2	240.2	167.1	118.0	99.0	44.8	22.8	15.6	10.0
1.88V	421.6	226.5	159.3	113.7	95.2	43.5	21.9	15.0	9.5

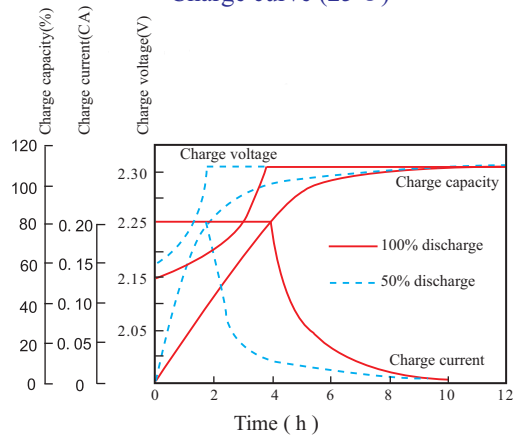
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hr	2hr	3hr	4hr	5hr	6hr	8hr	10hr
1.75V	2466	1530.6	1122.2	708.0	558.6	446.8	377.3	327.7	271.1	228.4
1.80V	2320	1430.7	1033.1	682.0	541.6	439.9	367.4	320.7	265.1	224.4
1.83V	2185	1336.9	966.2	656.9	529.5	428.0	357.5	311.8	258.2	220.4
1.85V	2040	1235.6	885.3	631.9	511.5	416.1	347.5	302.9	250.0	212.5
1.88V	1896	1114.1	810.3	599.7	483.4	399.2	337.6	295.9	243.3	206.5

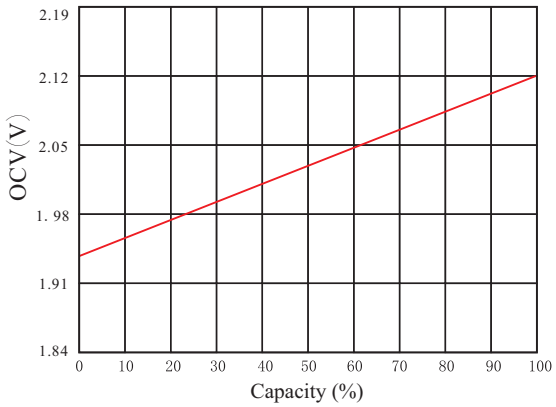
Discharge curve at different rate (25℃)



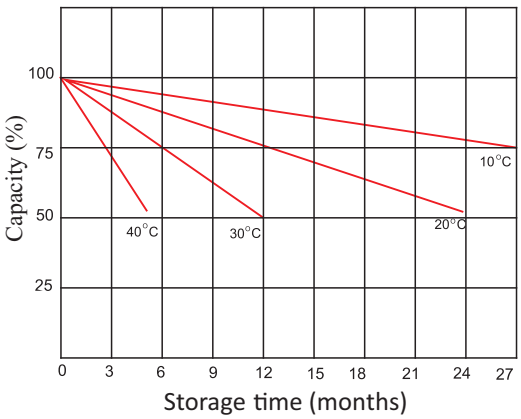
Charge curve (25℃)



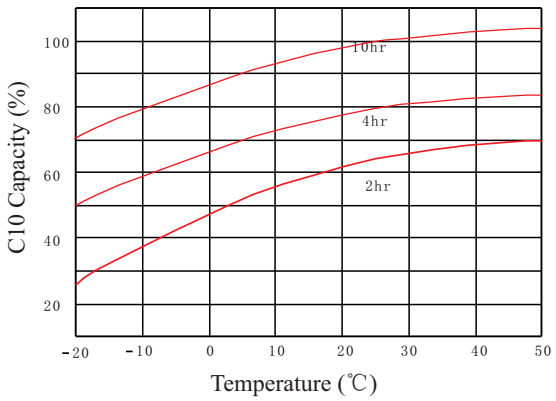
Capacity vs OCV curve



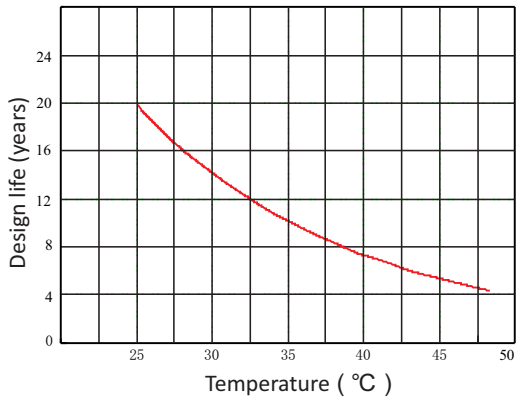
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature



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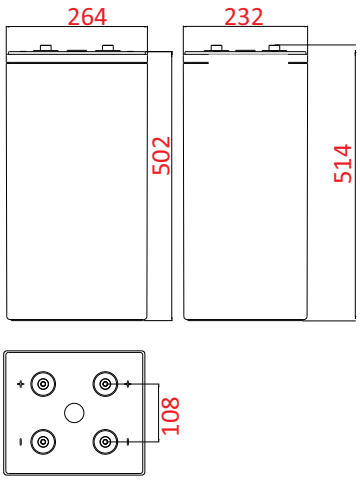
REXC-1000 -01-N-EN (ver 1.2-Oct.2015) Subject to revision without prior notice.E.&.O.E.

REXC series

REXC-1200

Dimension (mm)



Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Renewable energy storage
- Smart power grids and microgrids system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Home energy storage system
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Parameter

Nominal Voltage	2V
Capacity	1200Ah (10hr to 1.80V/cell @25℃)
	1440Ah (120hr to 1.85V/cell @25℃)
Typical Weight	90kg
Internal Resistance	Approx 0.14mΩ
Short-Circuit Current	13874A
Self Discharge	The residual capacity is above 90% after 90 days storage (25℃)
Temperature Ranges	Operation(recommended):15℃~25℃
	Operation(maximum):-40℃~50℃
Max. charging current	360A
Max. constant charging current	240A
Charge Voltage	Floating:2.25V (25℃)
	Equalizing/Cycle: 2. 30V(25℃)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N·m

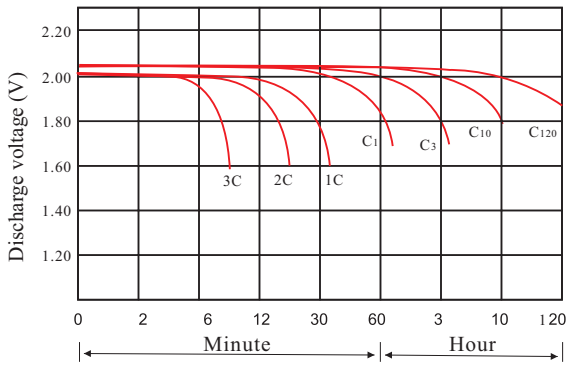
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	1hr	3hr	5hr	8hr	10hr	24hr	48hr	72hr	120hr
1.75V	664.2	321.4	219.0	150.4	125.5	56.5	28.9	19.8	12.5
1.80V	630.9	314.3	214.0	147.6	123.8	55.3	28.5	19.5	12.4
1.83V	595.2	304.7	210.7	146.7	123.2	55.3	28.4	19.4	12.3
1.85V	557.1	288.3	200.6	141.7	118.7	53.7	27.4	18.7	12.0
1.88V	505.9	271.8	191.2	136.4	114.3	52.2	26.3	18.0	11.4

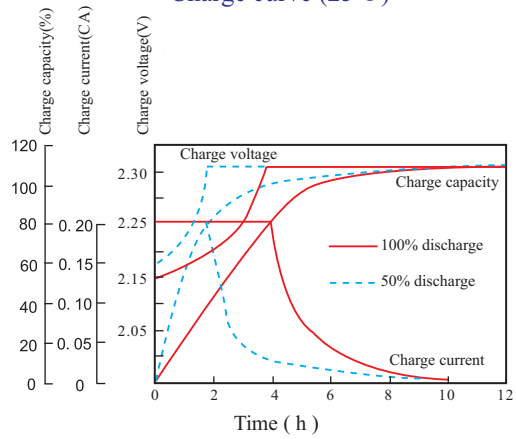
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hr	2hr	3hr	4hr	5hr	6hr	8hr	10hr
1.75V	2959	1836.8	1346.7	849.6	670.3	536.2	452.8	393.2	325.3	274.1
1.80V	2785	1716.8	1239.7	818.4	649.8	527.9	440.9	384.9	318.1	269.3
1.83V	2622	1604.4	1159.5	788.3	635.4	513.6	429.0	374.2	309.8	264.5
1.85V	2448	1482.8	1062.2	758.2	613.8	499.3	417.0	363.4	300.0	255.0
1.88V	2275	1336.9	972.4	719.7	580.0	479.0	405.1	355.1	291.9	247.8

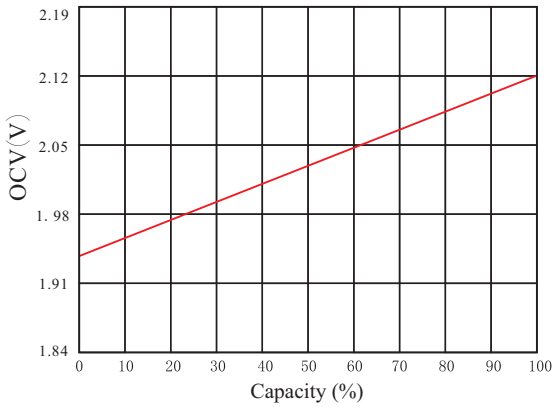
Discharge curve at different rate (25℃)



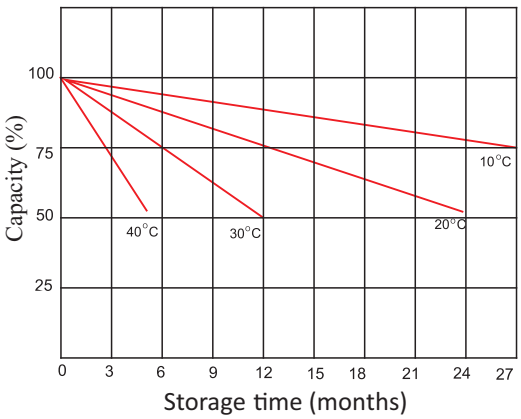
Charge curve (25℃)



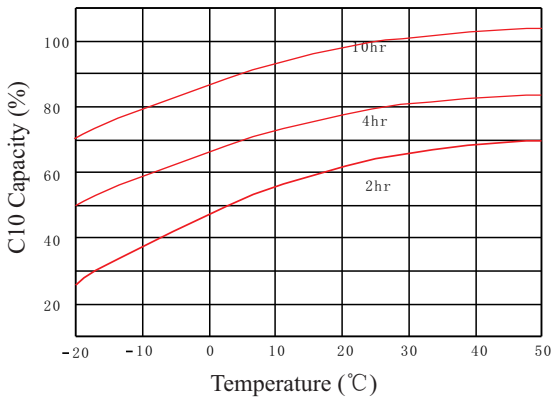
Capacity vs OCV curve



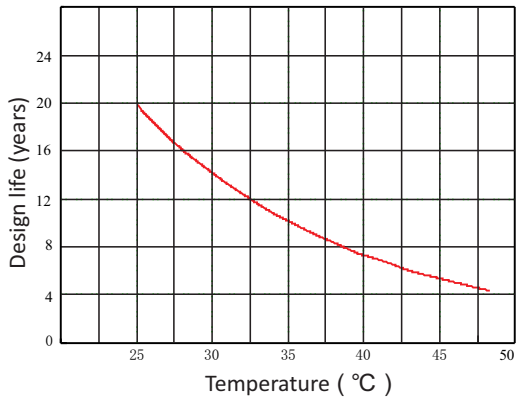
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature



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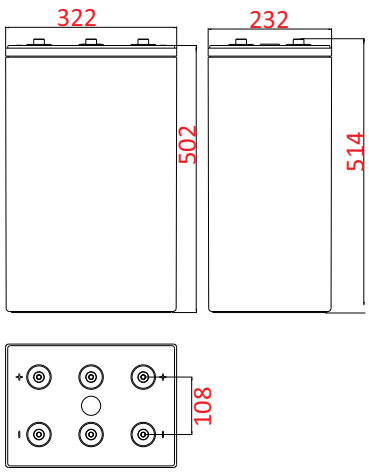
REXC-1200 -01-N-EN (ver 1.2-Oct.2015) Subject to revision without prior notice.E.&.O.E.

REXC series

REXC-1500

Dimension (mm)



Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Renewable energy storage
- Smart power grids and microgrids system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Home energy storage system
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Parameter

Nominal Voltage	2V
Capacity	1500Ah (10hr to 1.80V/cell @25℃) 1800Ah (120hr to 1.85V/cell @25℃)
Typical Weight	110kg
Internal Resistance	Approx 0.12mΩ
Short-Circuit Current	16882A
Self Discharge	The residual capacity is above 90% after 90 days storage (25℃)
Temperature Ranges	Operation(recommended):15℃~25℃ Operation(maximum):-40℃~50℃
Max. charging current	450A
Max. constant charging current	300A
Charge Voltage	Floating:2.25V (25℃) Equalizing/Cycle:2.30V(25℃)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N·m

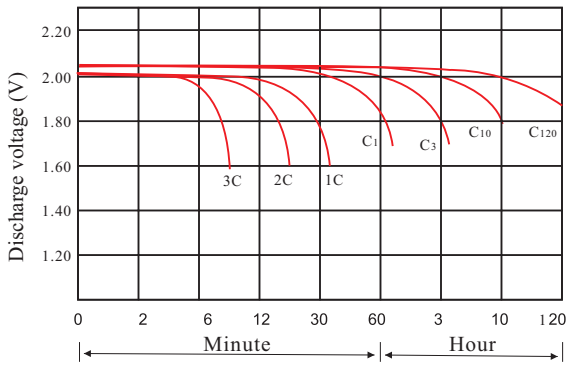
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	1hr	3hr	5hr	8hr	10hr	24hr	48hr	72hr	120hr
1.75V	830.3	401.8	273.8	188.0	156.8	70.7	36.1	24.7	15.7
1.80V	788.6	392.8	267.5	184.5	154.7	69.2	35.7	24.4	15.5
1.83V	744.0	380.9	263.4	183.4	154.0	69.2	35.5	24.3	15.4
1.85V	696.4	360.3	250.7	177.1	148.4	67.2	34.2	23.4	15.0
1.88V	632.4	339.8	239.0	170.6	142.8	65.2	32.9	22.5	14.3

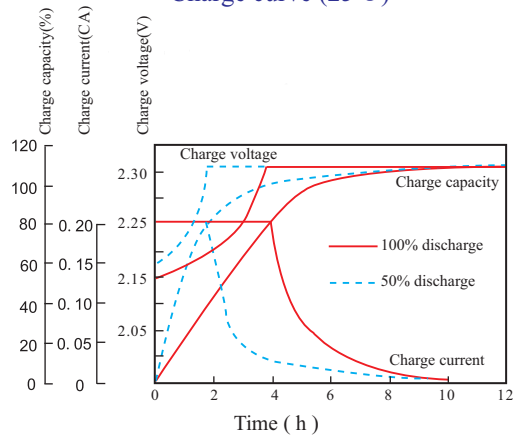
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hr	2hr	3hr	4hr	5hr	6hr	8hr	10hr
1.75V	3699	2295.9	1683.3	1062.1	837.9	670.3	566.0	491.5	406.6	342.6
1.80V	3480	2146.0	1549.6	1022.9	812.3	659.8	551.1	481.1	397.7	336.6
1.83V	3277	2005.4	1449.3	985.4	794.3	642.0	536.2	467.7	387.3	330.7
1.85V	3060	1853.9	1327.8	947.8	767.2	624.1	521.3	454.3	375.0	318.7
1.88V	2844	1671.2	1215.4	899.6	725.1	598.8	506.4	443.9	364.9	309.8

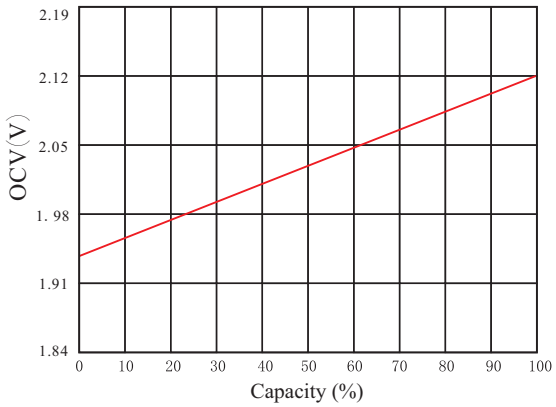
Discharge curve at different rate (25℃)



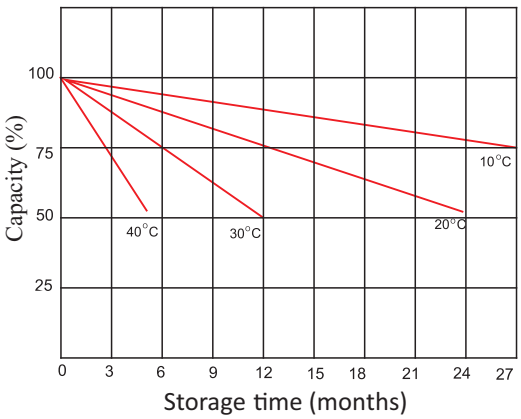
Charge curve (25℃)



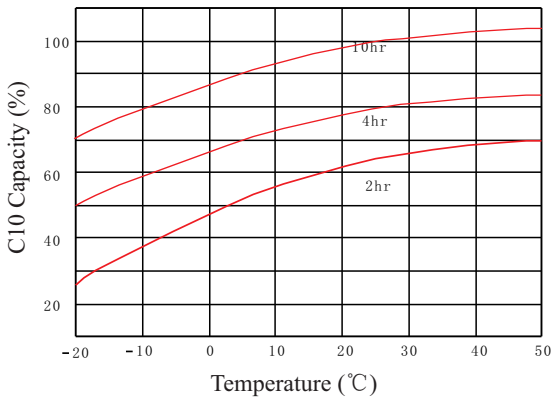
Capacity vs OCV curve



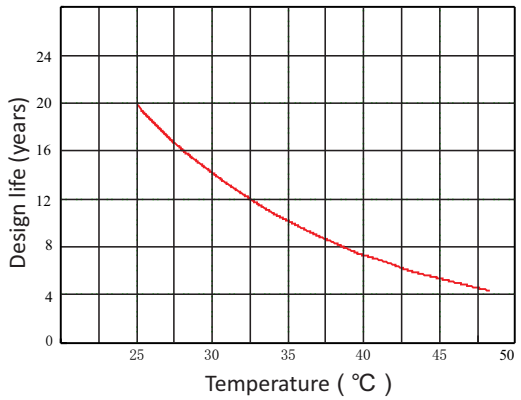
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature



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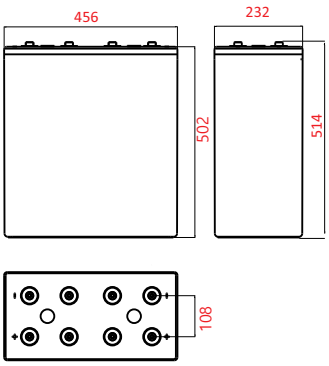
REXC-1500 -01-N-EN (ver 1.2-Oct.2015) Subject to revision without prior notice.E.&.O.E.

REXC series

REXC-2000

Dimension (mm)



Feature

- Design life 20 years
- Combine the advantage of lead acid battery and supercapacitor
- Ideal for PSOC cycle application
- High power, repid charge/discharge
- Reduce sulfation of negative plate, excellent recharge acceptance performance
- Waterproof, anti-salt treatment, shockproof module installation design
- Comply with IEC60896,IEC61427 etc. standard

Application

- Renewable energy storage
- Smart power grids and microgrids system
- Distributed energy storage system
- Hybrid energy storage system such as solar and wind
- Home energy storage system
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Generator and battery hybrid energy system
- Other standby, cycling system

Parameter

Nominal Voltage	2V
Capacity	2000Ah (10hr to 1.80V/cell @25℃)
	2400Ah (120hr to 1.85V/cell @25℃)
Typical Weight	155kg
Internal Resistance	Approx 0.10mΩ
Short-Circuit Current	20660A
Self Discharge	Residual capacity is above 90% after 90 days storage (25℃)
Temperature Ranges	Operation(recommended):15℃~25℃
	Operation(maximum):-40℃~50℃
Max. charging current	500A
Max. constant charging current	400A
Charge Voltage	Floating:2.25V (25℃)
	Equalizing/Cycle : 2.30V(25℃)
Terminal	M8 embedded copper
Terminal Hardware Torque	>10N·m

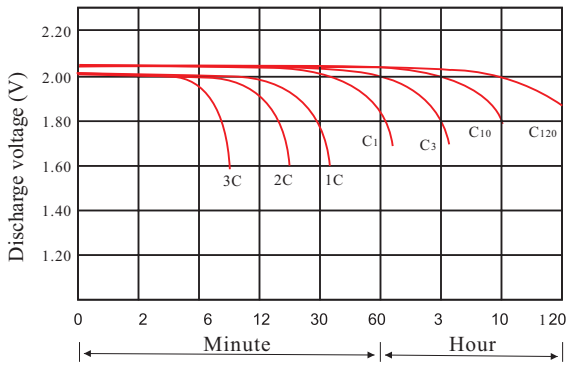
Constant Current Discharge Characteristics Units: Amperes(25℃)

End voltage per cell	1hr	3hr	5hr	8hr	10hr	24hr	48hr	72hr	120hr
1.75V	1107.0	535.7	365.0	250.7	209.1	94.2	48.2	33.0	20.9
1.80V	1051.5	523.8	356.7	246.0	206.3	92.2	47.5	32.5	20.6
1.83V	992.0	507.9	351.2	244.5	205.3	92.2	47.3	32.4	20.5
1.85V	928.5	480.4	334.3	236.1	197.9	89.6	45.6	31.2	20.0
1.88V	843.2	453.0	318.6	227.4	190.5	86.9	43.9	30.0	19.0

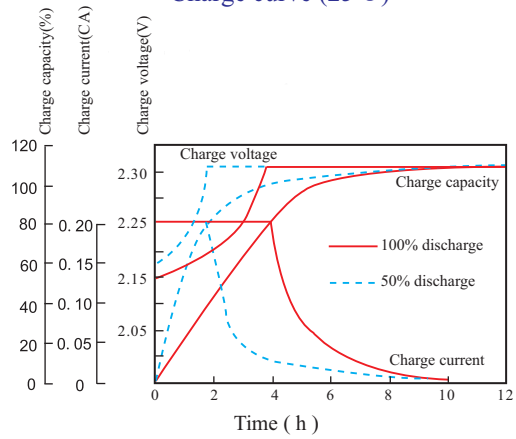
Discharge Data with Constant Power Units: Watts per cell(25℃)

End voltage per cell	15min	30min	1hr	2hr	3hr	4hr	5hr	6hr	8hr	10hr
1.75V	4932	3201.3	2200.4	1402.1	1106.2	893.7	754.7	655.4	542.2	456.8
1.80V	4640	3005.1	2025.7	1350.4	1072.4	879.8	734.8	641.5	530.2	448.8
1.83V	4370	2821.4	1894.6	1300.8	1048.6	855.9	714.9	623.6	516.3	440.9
1.85V	4080	2622.8	1735.8	1251.1	1012.8	832.1	695.1	605.7	500.1	425.0
1.88V	3792	2384.5	1588.8	1187.6	957.2	798.3	675.2	591.8	486.6	413.1

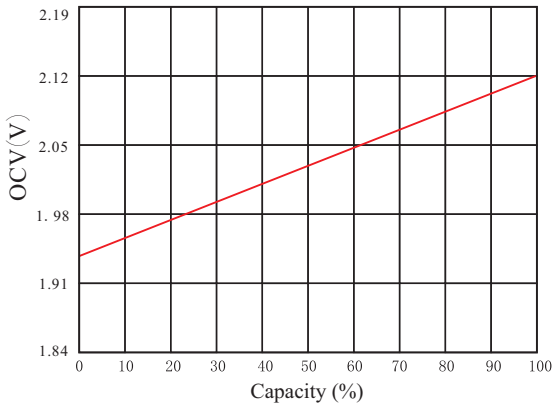
Discharge curve at different rate (25℃)



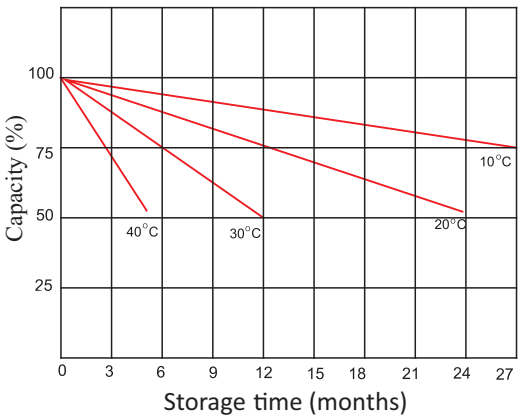
Charge curve (25℃)



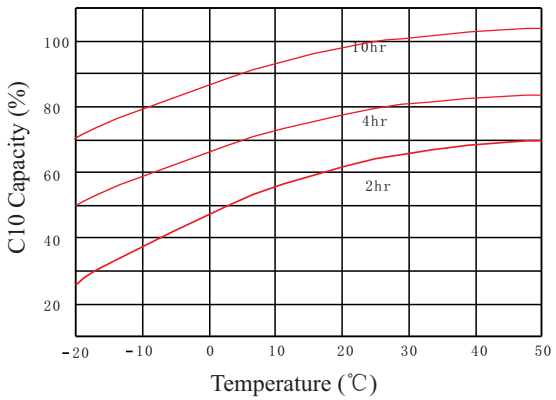
Capacity vs OCV curve



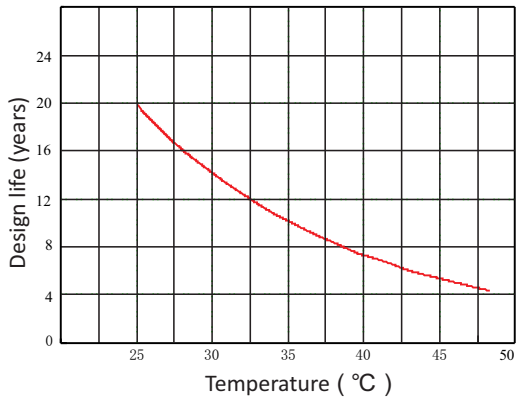
Residue capacity vs storage time



Capacity vs temperature curve



Design life vs temperature



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REXC-2000 -01-N-EN (ver 1.2-Oct.2015) Subject to revision without prior notice.E.&O.E.

Narada®

LEAD-CARBON BATTERY

12REXC Series

OPERATION MANUAL

Version：V1.1

tempel group

NARADA POWER SOURCE CO., LTD

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Safety and Warning

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

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

⚠ Warning—do not smoke or use fire near batteries

⚠ Warning—do not use organic solvent to wash batteries

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

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

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

Please take care of the following marks in using

					
Warning	Electricity danger	Protecting your eyes	Watch Short-circuits	With adults custody	Do not put batteries into dustbin
					
Read the manual	Fire forbidden	Circle used			

Chapter One Introduction of 12REXC series

12REXC series battery is designed for renewable energy sources such as wind power and solar system, and developed for home energy system with long life, high energy efficiency, superb security and reliability characteristic, which can be applied to energy storage system, telecom and generator, etc.

1. Product Characters

- Lead carbon battery add carbon material with high capacitance or highly conductive into the negative electrode, combine the advantages of lead acid battery and super capacitors, lead carbon battery provide not only high energy density, but also high power, rapid charge and discharge, longer cycle life.
- Combine the advantages of lead acid battery and super capacitors
- Ideal for PSOC cycle application
- Excellent recharge acceptance performance, super fast charge/large discharge performance
- Reduce sulfation of the negative plate, longer cycle life

1.1 Design life is above 20 years

Grid alloy with special patented formula

Special patented negative paste formula

4BS paste technology

Extra-thick plate design

1.2 Initial capacity above 100%, the remaining capacity above 90% when storage for 3 months (25ºC)

1.3 Remarkable high rate discharge performance.

Low internal resistance. Patented grid design. Large section copper structure

1.4 Innovation patented lead carbon technology

The innovation patented lead carbon technology can solve sulfation of the negative plate when used underfilling; compare with tradition VRLA battery, cycle life of the lead carbon battery can be extended 3-10 times

1.5 Ideal for PSOC cycle application

Cycle use at 80% SOC (part state of charge) can be longer PSOC cycle life, which especially designed for solar or wind energy storage system

1.6 Supply the unique flexible connectors made of rubber wrapped with copper wires and another option is copper bar connector.

Assure the good connections of post and connectors and low connection resistance;

Combination of suppleness and rigidity for more flexible connections;

1.7 Flexible and convenient installation, slinky outside looking

Shockproof blocking assembling

Satisfy customer's individual requirements and provide up to 8-class shockproof

Streamline and dime-light battery outside-looking design.

2. Main applications

- Home energy storage system
- Hybrid energy system such as solar and wind energy
- Distributed energy storage system
- Smart power grids and microgrids system
- Generator and battery hybrid energy system
- Solar power generation grid/off-grid energy storage system
- Emergency lighting system
- Other standby, cycling system

3. Configuration

Fig. 1-1 Configuration

4. Types and Dimensions

Table 1-1 type specifications

Battery Type	Rated Voltage per cell (V)	Rated Capacity (Ah)		Dimensions (mm)				Weight (Kg)
		C_{10}	C_{100}	Length	Width	Height	Overall Height	
		End-voltage 1.80V	End-voltage 1.85V					
12REXC70	2	60	70	280	180	230	244	30
12REXC200	2	165	200	438	227	281	294	79.5
6REXC300	2	250	300	338	227	281	294	61

5.Lead Carbon Working Principle

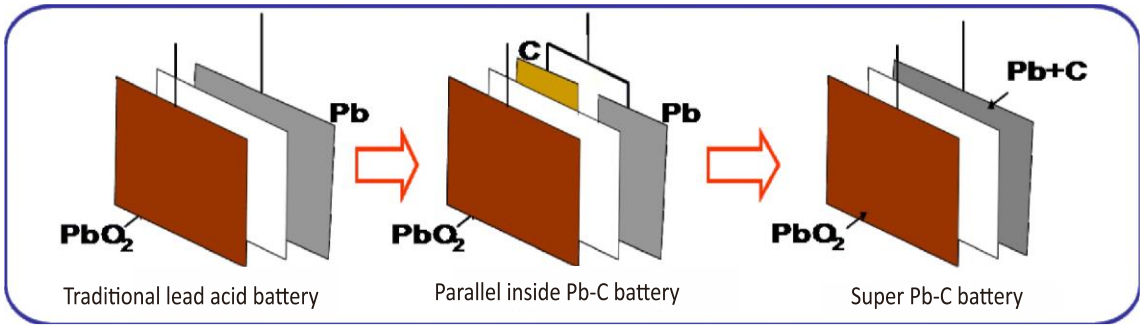


Fig.1-2 Lead carbon battery working principle sketch map

It forms a new active center in negative electrode by adding active carbon, that can reduce lead deposition overpotential, the lead sulfate will be translated into lead more easily. Growing up of lead sulfate can be suppressed efficiently through this technology.

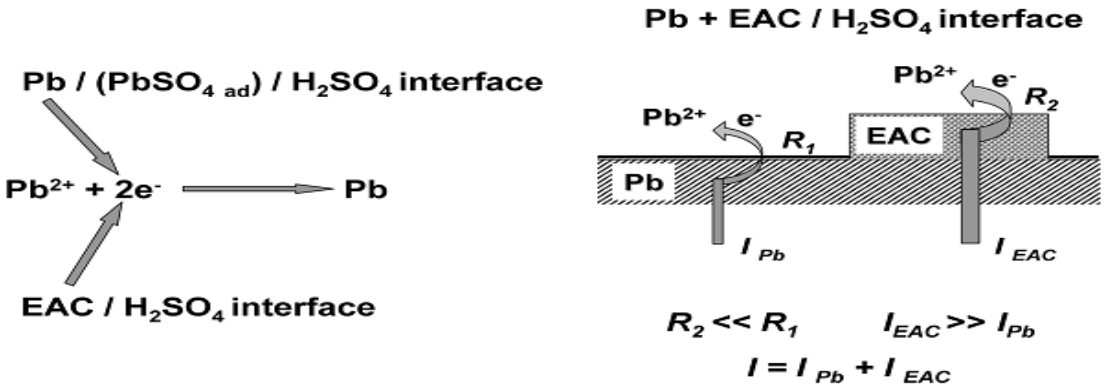


Fig.1-3 Lead carbon negative electrode surface current distribution sketch map

The chemical reaction taking place in lead carbon battery is as follows:
positive electrode:

$$PbO_2(s) + HSO_4^-(aq) + 3H^+(aq) + 2e^- \underset{charge}{\overset{discharge}{\rightleftharpoons}} PbSO_4(s) + 2H_2O(1)$$

negative electrode:

$$nC_6^{x^-}(H^+)_x(aq) \underset{charge}{\overset{discharge}{\rightleftharpoons}} nC_6^{(x-2)^-}(H^+)_{x-2}(aq) + 2H^+(aq) + 2e^-$$

Because of the reaction is based on double layer capacitance which caused from carbon electrode/electrolyte interface, thereby the lead carbon battery has part characteristic of super capacitors. Thus the lead carbon battery can possess large current and long cycle life performances.

12REXC battery adopts a design of barren-liquor and utilizes AGM (micro porous glass fiber) separator. Thus there is a path existing between the positive and the negative. Also special alloy grid is chosen to increase vent hydrogen over-potential gassing on the negative plate, which prevents generation of hydrogen. Otherwise, the oxygen generated from positive diffuses through separator to the negative and the oxygen gas reacts quickly and is recombined into water. The reactions are as follows: :

$2Pb + O_2 \longrightarrow 2PbO;$

$PbO + H_2SO_4 \longrightarrow PbSO_4 + H_2O;$

So it is possible to build 12REXC battery in sealed structure.

Chapter Two Technical characteristic

1. Discharge Curve and Discharge Data

Fig. 2-1 12REXC Battery Discharge Performance Curves at Different Discharge Rates

(25℃)

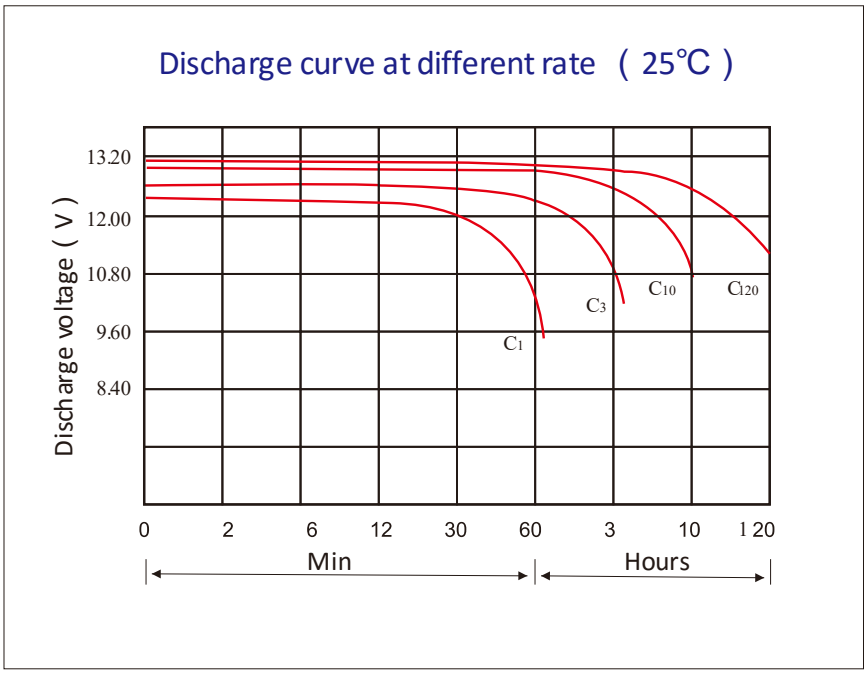


Fig.2-1 Discharge characteristic curve

2. Charge Curve

Fig.2-2 Recharge characteristics of 12REXC battery with current of 0.1C_{10}A and limit voltage of 2.30V/cell (25℃). The 100% DOD battery can be recharged 105% of capacity after charging for 24 hours. Imaginary line is the recharge curve of 50%DOD.

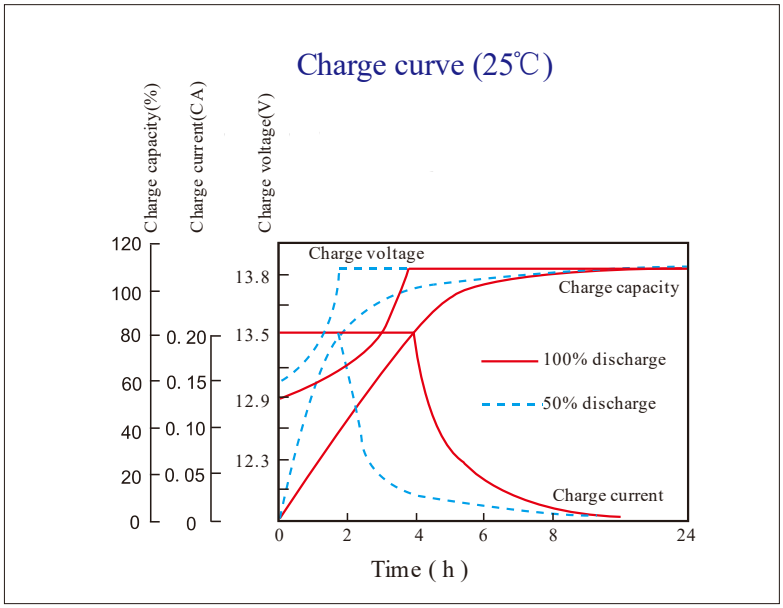


Fig.2-2 Charge characteristic curve

3. Internal Resistance and Short-Circuit Current

The internal resistance of the battery is a dynamic nonlinear parameter that is continuously changed along with the temperature and discharge state. The internal resistance is the lowest when battery is fully charged. The table 2-3 shows the internal resistance and short circuit current of 12REXC battery in fully charged state according to the IEC60896 standard. Pay attention to the battery to short-circuit causes the battery voltage to reduce to 0V, and will cause the battery internal component damaged.

Table 2-3 Referenced Internal Resistance and Short Current

Battery Type	Internal Resistance (mΩ)	Short Current (A)
12REXC70	9.79	1291
12REXC200	3.83	3274
6REXC300	1.35	4619

Chapter Three Operation and Maintenance

1. Parameters Setup

Table3-1 Home energy storage system parameter setup table (48V system)

Parameter name	Unit	Grid	Off-grid
Floating Voltage per cell	V/cell	2.25	2.25
Equalization Voltage per cell	V/cell	2.30	2.30
Charging Current	A/cell	$0.1C_{10}$	$0.2C_{10}$
Discharge under-voltage protection per cell	V	Please refer to table 3-2	
Condition To Change Equalization Charge To Float Charge	mA/Ah	< 5	< 5
Condition to Change Float Charge To Equalization Charge	mA/Ah	> 50	> 50
Pack equalization voltage	V	55.2	55.2
Pack floating voltage	V	54.0	54.0
Pack charging current	A	0.1C10	0.2C10
Pack discharge under-voltage protection	V	Please refer to table 3-2	
Temperature Compensate Ratio With Floating Voltage	mV/℃ / cell	-3	-3
Temperature Compensate Ratio With Equalization Voltage	mV/℃ / cell	-5	-5
High Temperature Warning	℃	35	35
Short circuit protection current	A	Please refer to table 3-2	

1. The voltage in above table is at 25℃. Please adjust the data according to table 3-3 at other temperature.

2. Energy storage system can be off-grid power supply and grid power supply according to real situation. The off-grid defined as tough power supply, to protect the battery better, please set refer to above table or contact to manufacture.

3. Above are standard setup parameters in table 3-1. We suggest you to set up end voltage (LVBD) based on different load current to make the battery life longer. Please refer to table 3-2.

Table 3-2 Voltage setup parameter of LVBD and LVLD

Load current (A)	End voltage (V/cell)	LVBD for 48V system (V)
$I < 0.025C_{10}$	1.97	47.3
$0.025C_{10} \leq I < 0.05C_{10}$	1.92	46.1
$0.05C_{10} \leq I < 0.1C_{10}$	1.87	44.9

$0.1C_{10} \leq I < 0.2C_{10}$	1.83	43.92
$0.2C_{10} \leq I < 0.5C_{10}$	1.75	42.0

If the battery is not recharged in time after discharge, or the power is off again during recharge, the insufficient-charged batteries will be frequently discharge, thus the batteries will lose part of capacity in short period. And it may cause capacity loss at initial stage and the batteries will be rejected if the situation is serious.

2. Capacity and Influence Factor

The capacity of battery is the capacity that battery can be discharged in the established conditions, expressed as signal C. The usual unit of capacity is ampere-hour, shortened as AH. The rated time is marked in the right and low corner of C, i.e. C_{10} is the capacity at 10 hours rate; C_3 is the capacity at 3 hours rate.

The capacity can be expressed in Rated Capacity or Actual Capacity. For Rated Capacity of 12REXC, please see Table 1-1. The Actual Capacity is the actual output capacity in certain discharge conditions, which is equal to product of the discharge current and the discharge time, the unit is AH. The actual capacity is effected by discharge rate, discharge mode, end voltage and temperature.

3. Ambient Temperature vs. Battery

The recommendation temperature for 12REXC is 15 ℃ ~ 25 ℃. Used at high or low temperature, battery performance will be affected. Table 3-3 is the working temperature range for battery.

Table 3-3 Working temperature range for battery

Working condition	Temperature range	Recommended temperature
Discharge	-40℃ ~ 50℃	15℃ ~ 25℃
Charge	-20℃ ~ 50℃	15℃ ~ 25℃
Storage	-20℃ ~ 40℃	15℃ ~ 25℃

Temperature affects capacity of the battery. Fig. 3-1 is the available capacity (10h rated, end voltage 1.80Vpc) curve vs. ambient temperature. When the temperature is low, the capacity will decrease, for example, the capacity will decrease 10% if temperature decreases from 25 ℃ to 0℃; And too low temperature will cause battery long term insufficient charged, also will make negative plates sulfate and make battery unable to discharge.

The capacity will increase at some range when temperature rises. For example the capacity will increase 5% if temperature raises from 25℃ to 35℃. But when the temperature go up further, the capacity will increase slowly, and at last stop increasing. However, high temperature will quicken up plates' corrosion and cause water loss, thus

shortens battery's life.

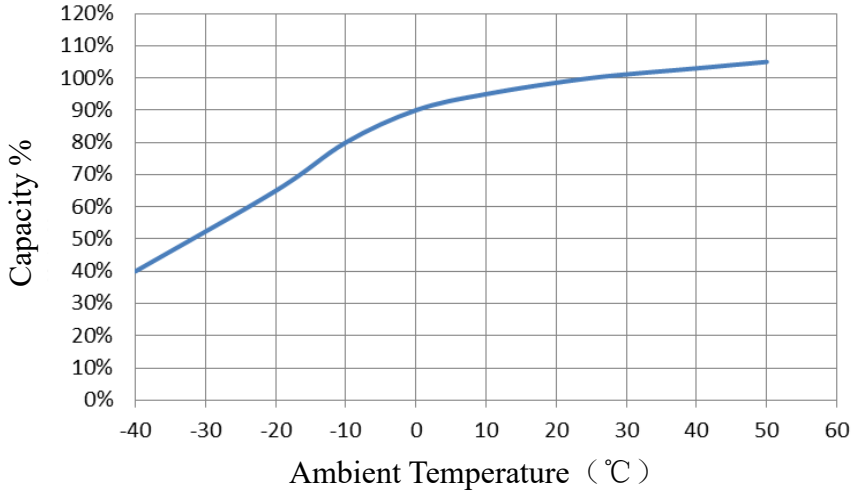


Fig.3-1 Available Capacity Curve VS. Ambient Temperature

3.1 Temperature and Floating Voltage, Equalization Voltage

The purpose to select certain floating voltage is make the battery operate in best conditions. If the floating voltage is higher, the floating current is also higher; it will accelerate the corruption of grids and shorten the life of the battery. If the floating voltage is lower, the battery can't be kept in fully charged state, this will crystallize $PbSO_4$, decrease the capacity, and also shorten the life of the battery. At 25℃, the floating voltage is 2.25V, at other temperature, please adjust according to Table 3-4. The temperature compensation coefficient for float charge is -3mV/℃/cell. Valve regulated sealed lead acid battery need to be equalized charge regularly, in order to guarantees the battery normal operation. 12REXC battery's equalization voltage is 2.30V/cell.

Floating and equalization setting voltage at different temperature

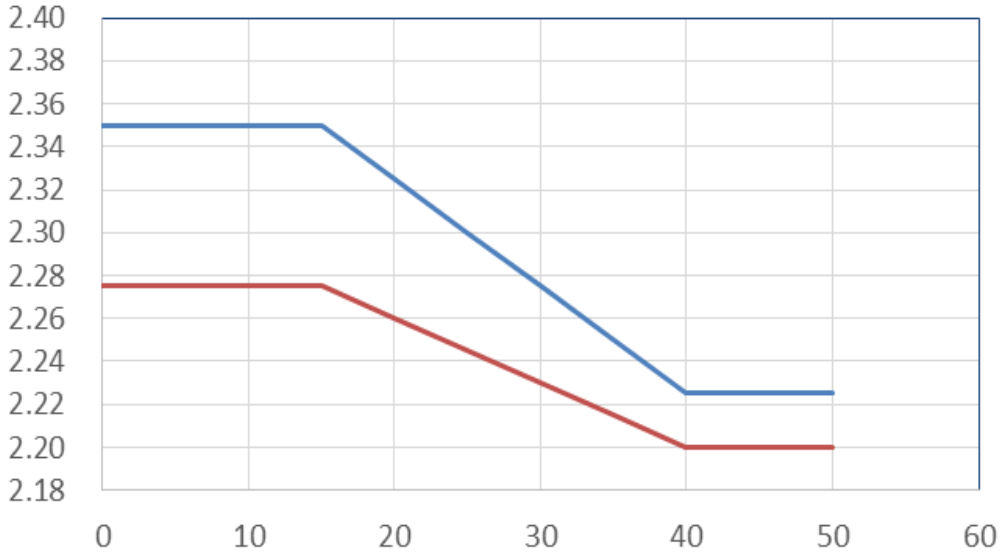


Fig. 3 - 2 The Voltage Setting Curve Vs. Ambient Temperature

If the voltage lower than 2.225 or higher than 2.35 after temperature correction, the suggesting adopted can be charging by 2.25V or 2.35V directly without using temperature compensation.

Table 3-4 Relationship of ambient temperature and voltage

Ambient Temperature(℃)	Equalization Voltage(V/cell)	Float Voltage(V/cell)
≤15	2.350	2.275
20	2.325	2.260
25	2.300	2.245
30	2.275	2.230
35	2.250	2.215
≥40	2.225	2.200

3.2 Ambient temperature vs. Battery Life

The high temperature will damage the battery, reduce the battery life. When temperature exceeds 25℃, the battery life will decrease half per 10℃ temperature raise. For example, the design life of battery is 20 years at 25℃, if the battery is operate at 35℃ for long term, the life will be 10 years. Below is the formula:

$$L_{25} = L_T \times 2^{(T-25)/10}$$

Notes：T is the actual ambient temperature;

L_T is designed life at T ambient temperature

L_{25} is designed life at 25℃ ambient temperature

Ambient temperature elevating, also will accelerate the battery grids corrosion and the

battery water loss, thus will greatly reduce the battery life. So it is important to control the ambient temperature. When heat is accumulated to a certain degree, it will damage the battery, seriously will lead to thermal run away. If indoor temperature reaches too high, please improve the ambient temperature by making room ventilated, etc. The battery spacing cannot to be less than 10mm, at the same time regulating cell floating and equalization voltage value according to handbook's request.

3.3 Conductance, Resistance vs. Capacity

There is a certain corresponding relationship between conductance & resistance and battery capacity. We suggest to test battery conductance and resistance data at different stage with same type instruments from same factory. Conductance and resistance data is only a reference to judge whether battery is good. These data cannot replace loading test to judge whether battery is good. Narada recommend to test these data on the surface or side of battery post. If there are several pairs of post, please test on nearest pair of post.

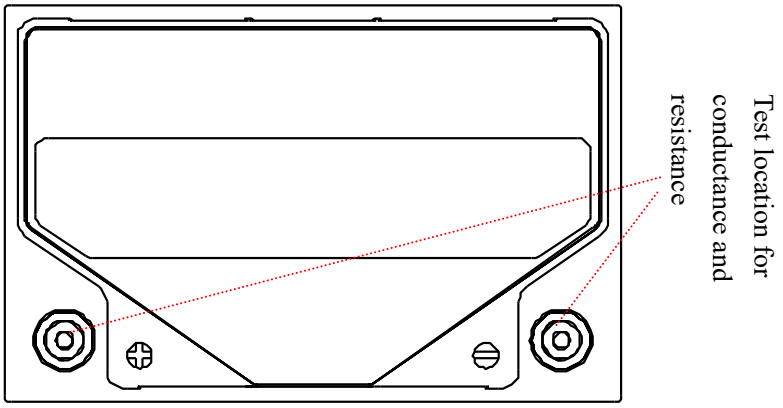


Figure 3-3 Test location for conductance and resistance

4. Requirement for Charge

4.1 Periodically Equalization Charge

The battery needs an equalization charge after floating operation over three months, or the voltage of at least two batteries are lower than 2.17V. The method of equalization charge is constant current and limited voltage, as follows: charge with constant current of 0.**1C$_{10}$A ~** 0.15C$_{10}$A till the average voltage reaches equalization charge voltage of 2.30Vpc (25℃), then keep charging with equalization charge voltage, meanwhile, the current is reduced, till the charge finished. The charging time is 24 hours.

4.2 Charge after discharge

After discharge, the batteries should be charged in time. The charge method is constant current limit voltage as follows: charge with constant current of

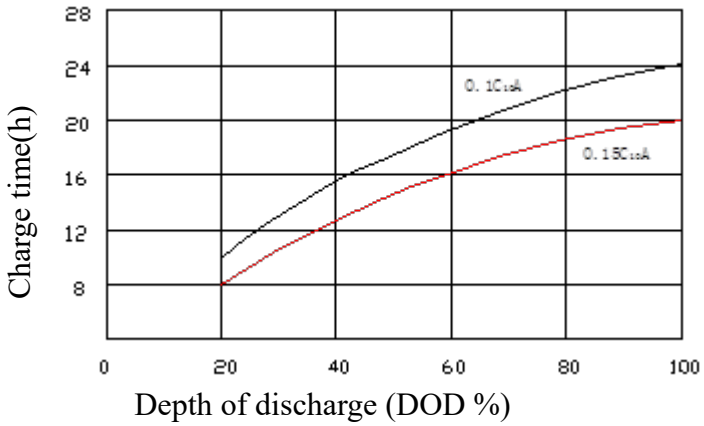
0.1C_{10}A ~ 0.20C_{10}A till the average voltage reaches a certain voltage, then keep charging with this voltage, meanwhile, the current is reduced, till the charge finished.

The certain voltage could be equalization voltage or float voltage. When the depth of discharge is larger (normally larger than 10%), equalization voltage is recommended so as to give fully charge to the battery. We can also determine charge voltage according to initial current. When the current is larger than 0.05C10A (reference current to change to equalization charge), equalization voltage is recommended. The charge time is 24 hours. We can also setup the charge voltage according to different DOD, different charge current shown in figure 3-4, or we can judge according to charge current value.

Normally, the batteries are fully charged when the value of charge current is not changed for continuous three hours at the stage of constant voltage charge,

Sometimes, we need to charge a battery in a short time, we can raise charge current, but not higher than 0.25C_{10}A.

Fig .3-4 The relationship between DOD and charge time



4.3 Battery recharging method

This method is used for battery charging for the first time after installing or battery recharging after long time storage.

- Recharging parameter

  We use equalizing charge to recharge the batteries, the parameter is as below:

  1 Charging mode: equalizing charge;

  2 Charging voltage: (2.30±0.002)V/cell;

  3 Charging current limited: 0.05C_{10}A;

  4 Cut-off condition: the charging current is less than 0.005C_{10} with another

extended 3 hours or charging time reached 24 hours (alternative);

- Recharging procedure

  1 Connect the batteries in series with cables or copper bars, and make sure that all the screws tightened with each joint, then connect the anode of battery group to the anode of charging equipment (charger), and the cathode of battery group to the cathode of charger.

  Pay attention: A breaker or fuse should be connected in the circuit in order to protect the batteries and charger, the capacity of breaker or fuse should be 1.5 times of circuit maximum current.

  2 Turn on the charger, set the charging voltage and current according to 4.1 recharging parameter.

  3 Turn the breaker or fuse, and then turn on the charger to recharging batteries.

  4 Stop charging when reaching the cut-off condition. At the last one hour before finishing, test the battery voltage one by one, the battery which voltage is below 2.16V/cell should be dealt with the method in chapter 3.3, if that battery can not accord with the requirement, it should be rejected.

- Cycle procedure

  We can use the method as below to recharge the batteries after long time storage (for example: more than 1 year):

  First connect the batteries in series to the charger, discharge batteries with constant current $0.25C_{10}$ (A) for about 3 hours. Then use the method above to charge the batteries. Stop charging when reach the cut-off condition.

  If the capacity still can not be renewed by this method, this means the batteries fail because of long time storage or other reasons.

4.4 Maintenance of wind/solar generating energy storage system

It is necessary to recharge one time every two months for maintenance because of the under-filling state of the batteries used in home energy storage system and wind/solar generating energy storage system. The battery maintenance method can operate as below:

In the case of mains supply, the maintenance and battery recharge methods be the same as clause 4.1.

In case of without mains supply, should cut off the load, then the solar and wind generating can charge the battery, but maximum limited voltage 2.30V/cell, maximum

current 0.20 C_{10} A. The battery fully charged on condition that the charging current is less than 0.005C_{10} or the charging voltage stay constant for four hours.

5. Storage

The storage area of 12REXC series batteries must be clean, ventilated, dry and without direct sunshine. All lead acid batteries lose capacity when standing on open circuit because of self-discharge. The result is that the voltage of open circuit is decreased, and the capacity also decreased. The self-discharge rate is related with ambient temperature. The self-discharge degree is smaller when the ambient temperature is lower, otherwise is larger. Batteries should be supplementary charged if they have been stored for six months or the open circuit voltage is lower than 2.10V/cell. The equalization charge method should be adopted. All batteries, which are ready to store, should be fully charged before storage. It's suggested to record storage time in periodic maintenance record and record the time when another necessary supplementary charge should be made. The quality certificates of 12REXC series batteries record the latest charge time of the batteries, next charge time can be calculated according to this charge time.

6. Maintenance

In order to assure service life, the batteries should be correctly inspected and maintained. The maintenance methods of 12REXC batteries are recommended as follows:

6.1 Monthly Maintenance

- Keep the battery-room clean.
- Measure and record the ambient temperature of the battery-room.
- Check each battery's cleanness; check damage and overheating trace of the terminal, container and lid.
- Measure and record the total voltage and floating current of the battery system.

6.2 Quarterly Maintenance

- Repeat monthly inspection.
- Measure and record floating voltage of every on-line battery. If more than two cells' voltage is less than 2.18Vpc after temperature compensation, the batteries need to be equalization charged.

6.3 Yearly Maintenance

- Repeat quarterly maintenance and inspection.
- Check whether connectors are loose or not every year and tight them
- Make a discharge test to check with exact load every year, discharging 30-40% of rated capacity. Make an 80%DOD capacity test every year after three years' operation.

6.4 Operation and Maintenance Precautions

Insufficient Charge

If the floating voltage is not set correctly (too low or not compensate according to temperature), the battery system will in an insufficient charge state for a long period of time. When the electricity is out, the battery may not be able to work

because the acid is satirized and the capacity is decreased.

Over Charge

If we neglect the performance of rectifier to transfer floating charge to equalization charge. If the rectifier cannot transfer charge modes because of its wrong performance or no adjustment, the battery system is always in an equalization charge state. Thus may cause serious problems for battery, such as water loss, life decrease, thermal runaway, deformation, etc.

Too low or too high temperature

We have mentioned that too low temperature will affect the capacity of battery. While too high temperature will also cause problems, such as water loss, life decrease, thermal runaway, deformation, etc.

Too low end voltage

The end voltage is also an important parameter for battery. The battery shall stop discharge when reach a certain voltage (The normal end voltage is 1.8Vpc for 10 hours rated). If the end voltage is too low, it will be difficult to recharge the battery and decrease the charge efficiency, thus reduce the life of battery.

Long time storage after discharge

If the battery is put aside without charge for a long time after discharge, it will affect the capacity and life of the battery, because some large size $PbSO_4$ will be created in the negative, which are difficult to transfer to active Pb. Thus it will affect battery life and capacity

Annex 1

VRLA Battery Regular Maintenance Record

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

Narada®

LEAD-CARBON BATTERY

REXC Series

OPERATION MANUAL

Version：V1.2

tempel group

NARADA POWER SOURCE CO., LTD

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Safety and Warning

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

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

⚠ Warning—do not smoke or use fire near batteries

⚠ Warning—do not use organic solvent to wash batteries

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

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

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

Please take care of the following marks in using

					
Warning	Electricity danger	Protecting your eyes	Watch Short-circuits	With adults custody	Do not put batteries into dustbin
					
Read the manual	Fire forbidden	Circle used			

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- Ideal for PSOC cycle application
- Excellent recharge acceptance performance, super fast charge/large discharge performance
- Reduce sulfation of the negative plate, longer cycle life

1.1 Design floating life is above 20 years

Grid alloy with special patented formula

Special patented negative paste formula

4BS paste technology

Extra-thick plate design

1.2 Superb security and reliability

Reliable seal performance, no acid spillage, recombination efficiency reach above 99%

1.3 Initial capacity above 100%, the remaining capacity above 90% when storage for 3 months (25ºC)

1.4 Remarkable high rate discharge performance.

Low internal resistance. Patented grid design. Large section copper structure

1.5 Innovation patented lead carbon technology

The innovation patented lead carbon technology can solve sulfation of the negative plate when used underfilling; compare with tradition VRLA battery, cycle life of the lead carbon battery can be extended 3-10 times

1.6 Ideal for PSOC cycle application

Cycle use at 80% SOC (part state of charge) can be longer PSOC cycle life, which especially designed for solar or wind energy storage system

1.7 Supply the unique flexible connectors made of rubber wrapped with copper wires

and another option is copper bar connector.

Assure the good connections of post and connectors and low connection resistance;

Combination of suppleness and rigidity for more flexible connections;

1.8 Flexible and convenient installation, slinky outside looking

Shockproof blocking assembling

Satisfy customer's individual requirements and provide up to 8-class shockproof Streamline and dime-light battery outside-looking design.

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3. Configuration

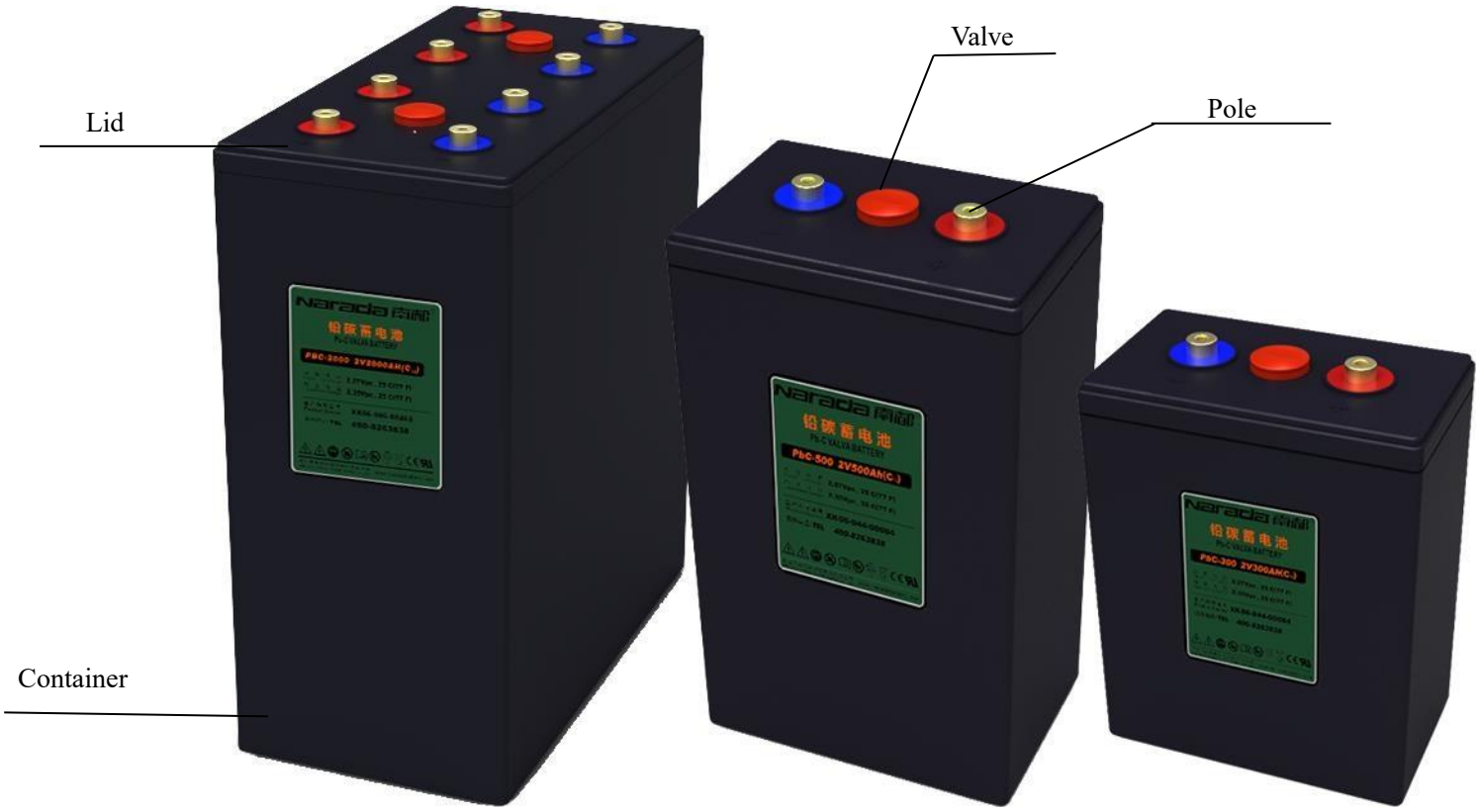


Fig. 1-1 Configuration

4. Types and Dimensions

Table 1-1 type specifications

Battery Type	Rated Voltage per cell (V)	Rated Capacity (Ah)		Dimensions (mm)				Weight (Kg)
		C_{10}	C_{120}	Length	Width	Height	Overall Height	
		End-voltage 1.80V	End-voltage 1.85V					
REXC-200	2	200	240	227	96	291	303	17
REXC-300	2	300	360	227	133	291	303	24
REXC-400	2	400	480	227	170	291	303	31
REXC-500	2	500	600	231	155	396	408	39
REXC-600	2	600	720	231	180	396	408	46
REXC-800	2	800	960	231	231	396	408	60
REXC-1000	2	1000	1200	231	282	396	408	75
REXC-1200	2	1200	1440	232	264	502	514	90
REXC-1500	2	1500	1800	232	322	502	514	110
REXC-2000	2	2000	2400	232	456	502	514	155

5.Lead Carbon Working Principle

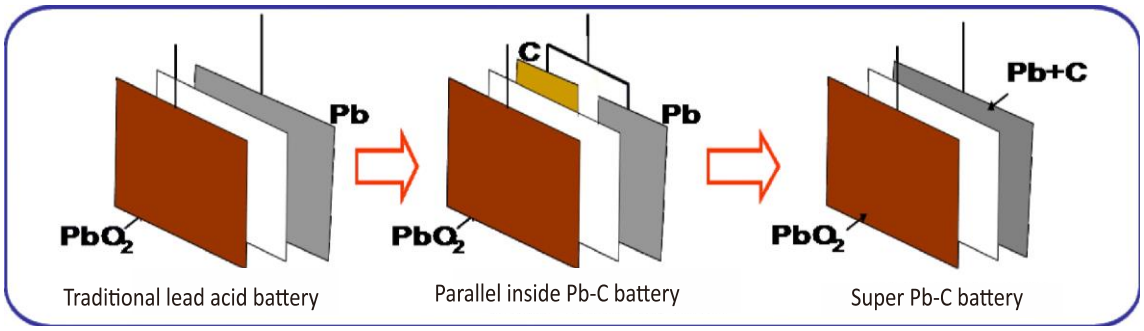


Fig.1-2 Lead carbon battery working principle sketch map

It forms a new active center in negative electrode by adding active carbon, that can reduce lead deposition overpotential, the lead sulfate will be translated into lead more easily. Growing up of lead sulfate can be suppressed efficiently through this technology.

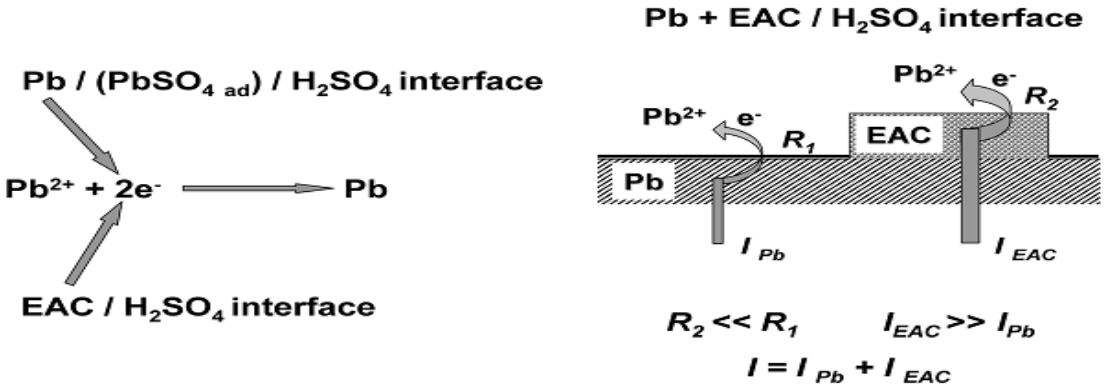


Fig.1-3 Lead carbon negative electrode surface current distribution sketch map

The chemical reaction taking place in lead carbon battery is as follows:
positive electrode:

$$PbO_2(s) + HSO_4^-(aq) + 3H^+(aq) + 2e^- \underset{charge}{\overset{discharge}{\rightleftharpoons}} PbSO_4(s) + 2H_2O(l)$$

negative electrode:

$$nC_6^{x-}(H^+)_x(aq) \underset{charge}{\overset{discharge}{\rightleftharpoons}} nC_6^{(x-2)-}(H^+)_{x-2}(aq) + 2H^+(aq) + 2e^-$$

Because of the reaction is based on double layer capacitance which caused from carbon electrode/electrolyte interface, thereby the lead carbon battery has part characteristic of super capacitors. Thus the lead carbon battery can possess large current and long cycle life performances.
REXC battery adopts a design of barren-liquor and utilizes AGM (micro porous glass fiber) separator. Thus there is a path existing between the positive and the negative.

Also special alloy grid is chosen to increase vent hydrogen over-potential gassing on the negative plate, which prevents generation of hydrogen. Otherwise, the oxygen generated from positive diffuses through separator to the negative and the oxygen gas reacts quickly and is recombined into water. The reactions are as follows: :

$2Pb + O_2 \longrightarrow 2PbO$;

$PbO + H_2SO_4 \longrightarrow PbSO_4 + H_2O$;

So it is possible to build REXC battery in sealed structure.

Chapter Two Technical characteristic

1. Discharge Curve and Discharge Data

Fig. 2-1 REXC Battery Discharge Performance Curves at Different Discharge Rates

(25℃)

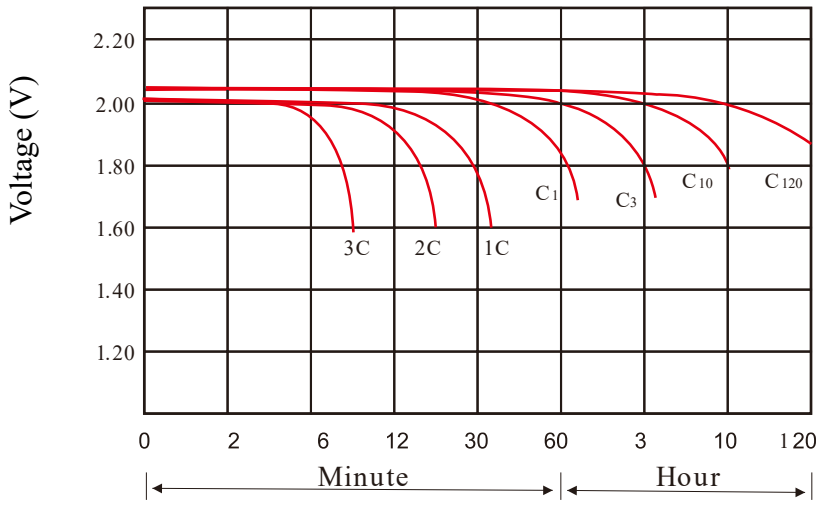


Fig.2-1 Discharge characteristic curve

2. Charge Curve

Fig.2-2 Recharge characteristics of REXC battery with current of $0.1C_{10}A$ and limit voltage of 2.30V/cell (25℃). The 100% DOD battery can be recharged 105% of capacity after charging for 24 hours. Imaginary line is the recharge curve of 50%DOD.

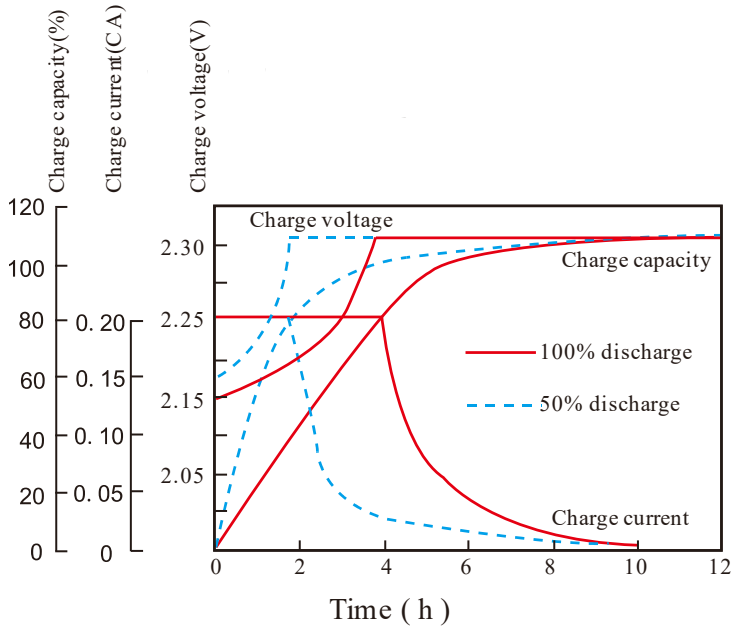


Fig.2-2 Charge characteristic curve

3. Internal Resistance and Short-Circuit Current

The internal resistance of the battery is a dynamic nonlinear parameter that is continuously changed along with the temperature and discharge state. The internal resistance is the lowest when battery is fully charged. The table 2-3 shows the internal resistance and short circuit current of REXC battery in fully charged state according to the IEC60896 standard. Pay attention to the battery to short-circuit causes the battery voltage to reduce to 0V, and will cause the battery internal component damaged.

Table 2-3 Referenced Internal Resistance and Short Current

Battery Type	Internal Resistance (mΩ)	Short Current (A)
REXC-200	0.55	3700
REXC-300	0.39	4752
REXC-400	0.30	6107
REXC-500	0.28	7211
REXC-600	0.23	8614
REXC-800	0.18	10873
REXC-1000	0.15	12835
REXC-1200	0.14	13874
REXC-1500	0.12	16882
REXC-2000	0.10	20660

Chapter Three Operation and Maintenance

1. Parameters Setup

Table3-1 Energy storage system parameter setup table (600V system)

Parameter name	Unit	Grid	Off-grid
Floating Voltage per cell	V/cell	2.25	2.25
Equalization Voltage per cell	V/cell	2.30	2.30
Charging Current	A/cell	$0.1C_{10}$	$0.2C_{10}$
Discharge under-voltage protection per cell	V	Please refer to table 3-2	
Condition To Change Equalization Charge To Float Charge	mA/Ah	< 5	< 5
Condition to Change Float Charge To Equalization Charge	mA/Ah	> 50	> 50
Pack equalization voltage	V	690	690
Pack floating voltage	V	675	675
Pack charging current	A	0.1C10	0.2C10
Pack discharge under-voltage protection	V	Please refer to table 3-2	
Temperature Compensate Ratio With Floating Voltage	mV/℃ / cell	-3	-3
Temperature Compensate Ratio With Equalization Voltage	mV/℃ / cell	-5	-5
High Temperature Warning	℃	35	35
Short circuit protection current	A	Please refer to table 3-2	

1. The voltage in above table is at 25℃. Please adjust the data according to table 3-3 at other temperature.

2. Energy storage system can be off-grid power supply and grid power supply according to real situation. The off-grid defined as tough power supply, to protect the battery better, please set refer to above table or contact to manufacture.

3. Above are standard setup parameters in table 3-1. We suggest you to set up end voltage (LVBD) based on different load current to make the battery life longer. Please refer to table 3-2.

Table 3-2 Voltage setup parameter of LVBD and LVLD

Load current（A）	End voltage（V/cell）	LVBD（V/pack）

$I < 0.025C_{10}$	1.97	594
$0.025C_{10} \leq I < 0.05C_{10}$	1.92	579
$0.05C_{10} \leq I < 0.1C_{10}$	1.87	564
$0.1C_{10} \leq I < 0.2C_{10}$	1.83	552
$0.2C_{10} \leq I < 0.5C_{10}$	1.75	528

If the battery is not recharged in time after discharge, or the power is off again during recharge, the insufficient-charged batteries will be frequently discharge, thus the batteries will lose part of capacity in short period. And it may cause capacity loss at initial stage and the batteries will be rejected if the situation is serious.

2. Capacity and Influence Factor

The capacity of battery is the capacity that battery can be discharged in the established conditions, expressed as signal C. The usual unit of capacity is ampere-hour, shortened as AH. The rated time is marked in the right and low corner of C, i.e. C_{10} is the capacity at 10 hours rate; C_3 is the capacity at 3 hours rate.

The capacity can be expressed in Rated Capacity or Actual Capacity. For Rated Capacity of REXC, please see Table 1-1. The Actual Capacity is the actual output capacity in certain discharge conditions, which is equal to product of the discharge current and the discharge time, the unit is AH. The actual capacity is effected by discharge rate, discharge mode, end voltage and temperature.

3. Ambient Temperature vs. Battery

The recommendation temperature for REXC is 15 ℃ ~ 25 ℃. Used at high or low temperature, battery performance will be affected. Table 3-3 is the working temperature range for battery.

Table 3-3 Working temperature range for battery

Working condition	Temperature range	Recommended temperature
Discharge	-40℃ ~ 50℃	15℃ ~ 25℃
Charge	-20℃ ~ 50℃	15℃ ~ 25℃
Storage	-20℃ ~ 40℃	15℃ ~ 25℃

Temperature affects capacity of the battery. Fig. 3-1 is the available capacity (10h rated, end voltage 1.80Vpc) curve vs. ambient temperature. When the temperature is low, the capacity will decrease, for example, the capacity will decrease 10% if temperature

decreases from 25 ℃ to 0℃; And too low temperature will cause battery long term insufficient charged, also will make negative plates sulfate and make battery unable to discharge.

The capacity will increase at some range when temperature rises. For example the capacity will increase 5% if temperature raises from 25℃ to 35℃. But when the temperature go up further, the capacity will increase slowly, and at last stop increasing. However, high temperature will quicken up plates' corrosion and cause water loss, thus shortens battery's life.

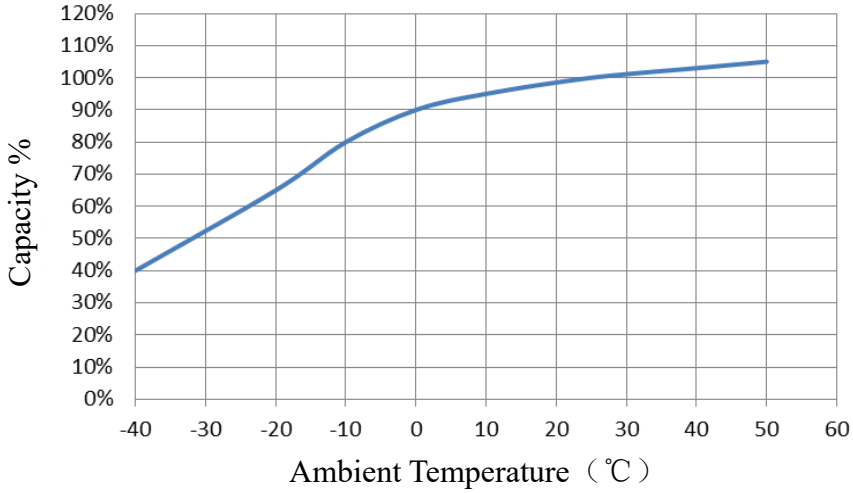


Fig.3-1 Available Capacity Curve VS. Ambient Temperature

3.1 Temperature and Floating Voltage, Equalization Voltage

The purpose to select certain floating voltage is make the battery operate in best conditions. If the floating voltage is higher, the floating current is also higher; it will accelerate the corruption of grids and shorten the life of the battery. If the floating voltage is lower, the battery can't be kept in fully charged state, this will crystallize $PbSO_4$, decrease the capacity, and also shorten the life of the battery. At 25℃, the floating voltage is 2.25V, at other temperature, please adjust according to Table 3-4. The temperature compensation coefficient for float charge is -3mV/℃/cell. Valve regulated sealed lead acid battery need to be equalized charge regularly, in order to guarantees the battery normal operation. REXC battery's equalization voltage is 2.30V/cell.

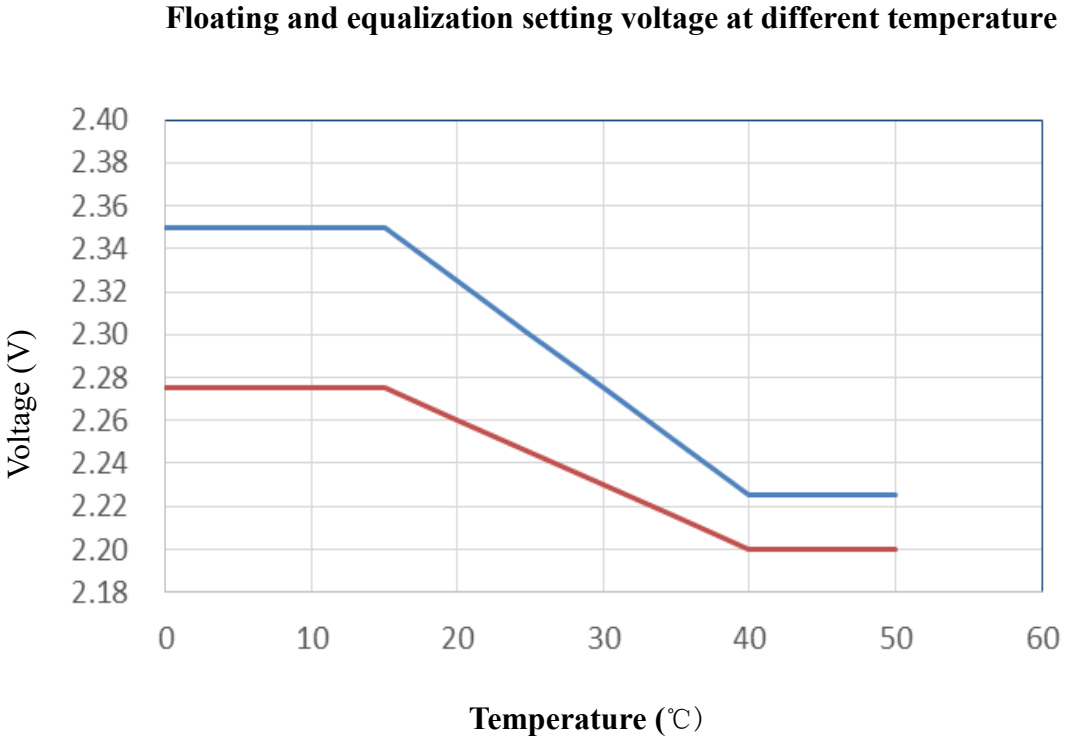


Fig. 3 - 2 The Voltage Setting Curve Vs. Ambient Temperature

If the voltage lower than 2.225 or higher than 2.35 after temperature correction, the suggesting adopted can be charging by 2.25V or 2.35V directly without using temperature compensation.

Table 3-4 Relationship of ambient temperature and voltage

Ambient Temperature(℃)	Equalization Voltage(V/cell)	Float Voltage(V/cell)
≤15	2.350	2.275
20	2.325	2.260
25	2.300	2.245
30	2.275	2.230
35	2.250	2.215
≥40	2.225	2.200

3.2 Ambient temperature vs. Battery Life

The high temperature will damage the battery, reduce the battery life. When temperature exceeds 25℃, the battery life will decrease half per 10℃ temperature raise. For example, the design life of battery is 20 years at 25℃, if the battery is

operate at 35℃ for long term, the life will be 10 years. Below is the formula:

$$L_{25} = L_T \times 2^{(T-25)/10}$$

Notes：T is the actual ambient temperature;

L_T is designed life at T ambient temperature

L_{25} is designed life at 25℃ ambient temperature

Ambient temperature elevating, also will accelerate the battery grids corrosion and the battery water loss, thus will greatly reduce the battery life. So it is important to control the ambient temperature. When heat is accumulated to a certain degree, it will damage the battery, seriously will lead to thermal run away. If indoor temperature reaches too high, please improve the ambient temperature by making room ventilated, etc. The battery spacing cannot to be less than 10mm, at the same time regulating cell floating and equalization voltage value according to handbook's request.

3.3 Conductance, Resistance vs. Capacity

There is a certain corresponding relationship between conductance & resistance and battery capacity. We suggest to test battery conductance and resistance data at different stage with same type instruments from same factory. Conductance and resistance data is only a reference to judge whether battery is good. These data cannot replace loading test to judge whether battery is good. Narada recommend to test these data on the surface or side of battery post. If there are several pairs of post, please test on nearest pair of post.

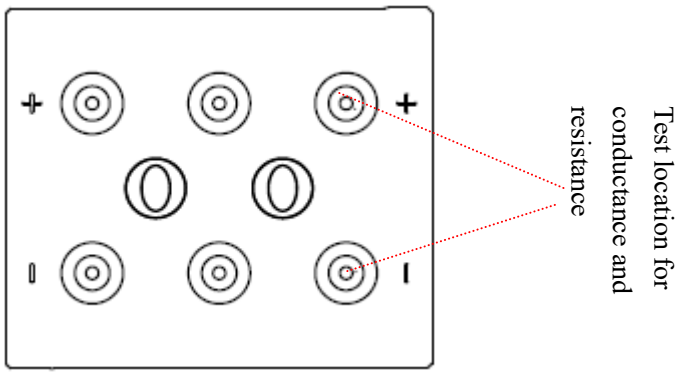


Figure 3-3 Test location for conductance and resistance

4. Requirement for Charge

4.1 Periodically Equalization Charge

The battery needs an equalization charge after floating operation over three months, or the voltage of at least two batteries are lower than 2.18V. The method of equalization charge is constant current and limited voltage, as follows: charge with constant current of $0.1C_{10}A$ ~ $0.15C_{10}A$ till the average voltage reaches equalization charge voltage of 2.30Vpc (25℃), then keep charging with

equalization charge voltage, meanwhile, the current is reduced, till the charge finished. The charging time is 24 hours.

4.2 Charge after discharge

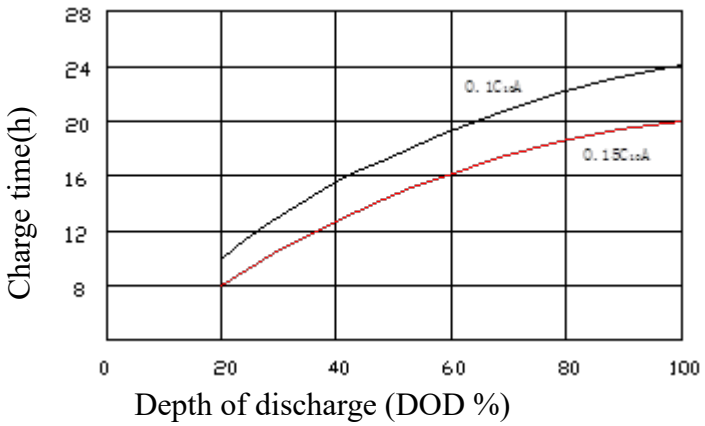
After discharge, the batteries should be charged in time. The charge method is constant current limit voltage as follows: charge with constant current of $0.1C_{10}A \sim 0.20C_{10}A$ till the average voltage reaches a certain voltage, then keep charging with this voltage, meanwhile, the current is reduced, till the charge finished.

The certain voltage could be equalization voltage or float voltage. When the depth of discharge is larger (normally larger than 10%), equalization voltage is recommended so as to give fully charge to the battery. We can also determine charge voltage according to initial current. When the current is larger than 0.05C10A (reference current to change to equalization charge), equalization voltage is recommended. The charge time is 24 hours. We can also setup the charge voltage according to different DOD, different charge current shown in figure 3-4, or we can judge according to charge current value.

Normally, the batteries are fully charged when the value of charge current is not changed for continuous three hours at the stage of constant voltage charge.

Sometimes, we need to charge a battery in a short time, we can raise charge current, but not higher than $0.25C_{10}A$.

Fig .3-4 The relationship between DOD and charge time



4.3 Battery recharging method

This method is used for battery charging for the first time after installing or battery recharging after long time storage.

- Recharging parameter

  We use equalizing charge to recharge the batteries, the parameter is as below:

1 Charging mode: equalizing charge;

2 Charging voltage: (2.30±0.002)V/cell;

3 Charging current limited: $0.05C_{10}A$;

4 Cut-off condition: the charging current is less than $0.005C_{10}$ with another extended 3 hours or charging time reached 24 hours (alternative);

- Recharging procedure

1 Connect the batteries in series with cables or copper bars, and make sure that all the screws tightened with each joint, then connect the anode of battery group to the anode of charging equipment (charger), and the cathode of battery group to the cathode of charger.

Pay attention: A breaker or fuse should be connected in the circuit in order to protect the batteries and charger, the capacity of breaker or fuse should be 1.5 times of circuit maximum current.

2 Turn on the charger, set the charging voltage and current according to 4.1 recharging parameter.

3 Turn the breaker or fuse, and then turn on the charger to recharging batteries.

4 Stop charging when reaching the cut-off condition. At the last one hour before finishing, test the battery voltage one by one, the battery which voltage is below 2.16V/cell should be dealt with the method in chapter 3.3, if that battery can not accord with the requirement, it should be rejected.

- Cycle procedure

We can use the method as below to recharge the batteries after long time storage (for example: more than 1 year):

First connect the batteries in series to the charger, discharge batteries with constant current $0.25C_{10}$ (A) for about 3 hours. Then use the method above to charge the batteries. Stop charging when reach the cut-off condition.

If the capacity still can't be renewed by this method, this means the batteries fail because of long time storage or other reasons.

4.4 Maintenance of wind/solar generating energy storage system

It is necessary to recharge one time every two months for maintenance because of the under-filling state of the batteries used in home energy storage system and wind/solar generating energy storage system. The battery maintenance method can operate as below:

In the case of mains supply, the maintenance and battery recharge methods be the same as clause 4.1.

In case of without mains supply, should cut off the load, then the solar and wind generating can charge the battery, but maximum limited voltage 2.30V/cell, maximum current 0.20 C_{10} A. The battery fully charged on condition that the charging current is less than 0.005C_{10} or the charging voltage stay constant for four hours.

5. Storage

The storage area of REXC series batteries must be clean, ventilated, dry and without direct sunshine. All lead acid batteries lose capacity when standing on open circuit because of self-discharge. The result is that the voltage of open circuit is decreased, and the capacity also decreased. The self-discharge rate is related with ambient temperature. The self-discharge degree is smaller when the ambient temperature is lower, otherwise is larger. Batteries should be supplementary charged if they have been stored for six months or the open circuit voltage is lower than 2.10V/cell. The equalization charge method should be adopted. All batteries, which are ready to store, should be fully charged before storage. It's suggested to record storage time in periodic maintenance record and record the time when another necessary supplementary charge should be made. The quality certificates of REXC series batteries record the latest charge time of the batteries, next charge time can be calculated according to this charge time.

6. Maintenance

In order to assure service life, the batteries should be correctly inspected and maintained. The maintenance methods of REXC batteries are recommended as follows:

6.1 Monthly Maintenance

- Keep the battery-room clean.
- Measure and record the ambient temperature of the battery-room.
- Check each battery's cleanness; check damage and overheating trace of the terminal, container and lid.
- Measure and record the total voltage and floating current of the battery system.

6.2 Quarterly Maintenance

- Repeat monthly inspection.
- Measure and record floating voltage of every on-line battery. If more than two cells' voltage is less than 2.18Vpc after temperature compensation, the batteries need to be equalization charged.

6.3 Yearly Maintenance

- Repeat quarterly maintenance and inspection.
- Check whether connectors are loose or not every year and tight them
- Make a discharge test to check with exact load every year, discharging 30-40% of rated capacity. Make an 80%DOD capacity test every year after three years' operation.

6.4 Operation and Maintenance Precautions

Insufficient Charge

If the floating voltage is not set correctly (too low or not compensate according to temperature), the battery system will in an insufficient charge state for a long period of time. When the electricity is out, the battery may not be able to work because the acid is satirized and the capacity is decreased.

Over Charge

If we neglect the performance of rectifier to transfer floating charge to equalization charge. If the rectifier cannot transfer charge modes because of its wrong performance or no adjustment, the battery system is always in an equalization charge state. Thus may cause serious problems for battery, such as water loss, life decrease, thermal runaway, deformation, etc.

Too low or too high temperature

We have mentioned that too low temperature will affect the capacity of battery. While too high temperature will also cause problems, such as water loss, life decrease, thermal runaway, deformation, etc.

Too low end voltage

The end voltage is also an important parameter for battery. The battery shall stop discharge when reach a certain voltage (The normal end voltage is 1.8Vpc for 10 hours rated). If the end voltage is too low, it will be difficult to recharge the battery and decrease the charge efficiency, thus reduce the life of battery.

Long time storage after discharge

If the battery is put aside without charge for a long time after discharge, it will affect the capacity and life of the battery, because some large size $PbSO_4$ will be created in the negative, which are difficult to transfer to active Pb. Thus it will affect battery life and capacity

Annex 1

VRLA Battery Regular Maintenance Record

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

BATTERY CYCLIC PERFORMANCE CALCULATION AND ESTIMATION

V1.2, 21st Oct. 2015

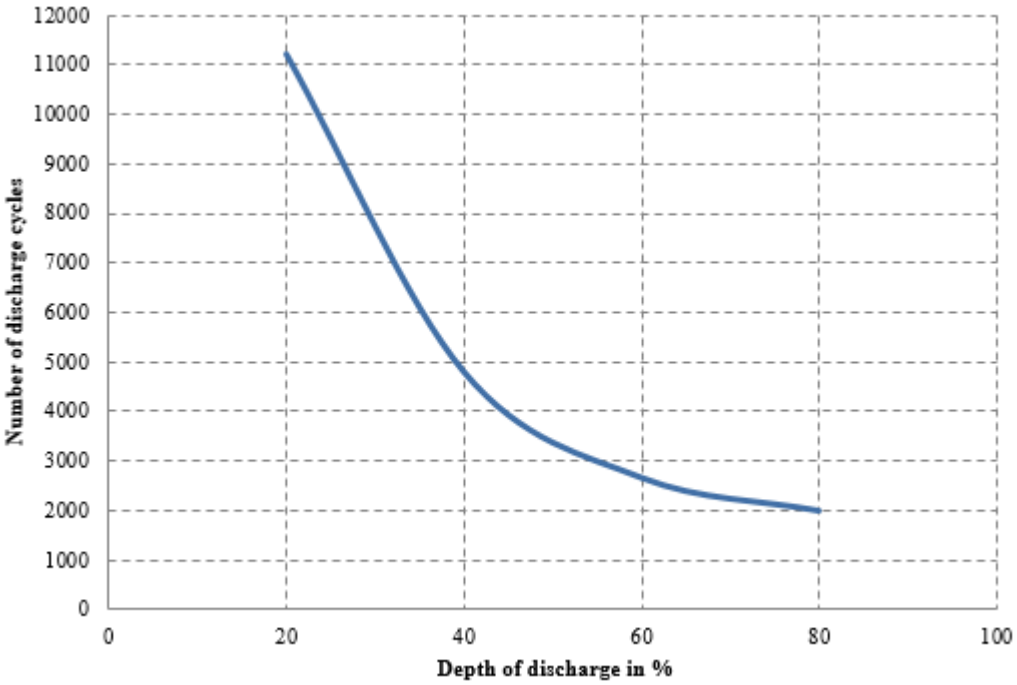
Note:

Lead carbon technology is a way to increase battery fast charge performance and PSOC performance. Nano carbon applied in negative can significantly increase reaction superficial area and conductance, nano carbon like fibers uniformly mixed into negative active material, which could be reaction points and better conductance, and this change makes battery be avoided negative lead sulphation issue to increase PSOC cyclic performance.

Lead carbon technology can be applied to existing deep cycle battery types.
But lead-carbon technology battery are not recommended for fully charged scenarios.

1. Ideal Cyclic Performance

1.1 REXC(2V&12V) Series Cyclic Test Result



Graph 1, Cycle life vs. DOD of REXC(2V&12V) Series with Ideal Charge Model

Table 1, data of cycle number

	Depth of Discharge/DOD			
	20%	40%	60%	80%
Cycle life	11200	4800	2700	2000

1.2 Discharge & Charge Scenario (80%DOD)

1) Cycle method: Discharge with $2I_{10}$ for 4 hours (80% DOD), charge with $2I_{10}$ for 3.5hour + I_{10} for 0.5hour + $0.25I_{10}$ for 3.5hour. This is one cycle.

2) Residue Capacity determination: The batteries are discharged at 10 hour rate after every 50 cycles to test battery capacity. When residue capacity of 10 hour rate capacity is lower than 80%, test is ended.

After discharge at 10 hour rate after every 50cycles, the charge method is: charge 80% of discharged capacity with current of $2I_{10}$ + charge 20% with current of I_{10} + charge 20% with current of $0.4I_{10}$ (i.e. charge 120% of discharged capacity)

3) Temperature: 25℃

1.3 Advantage of Upper Constant Current Charge Model

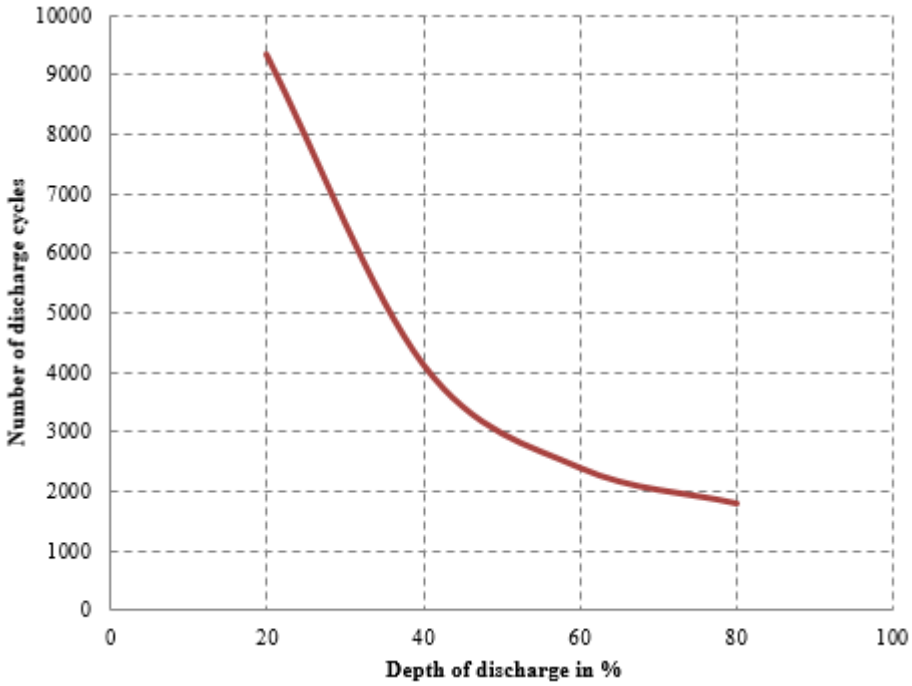
Battery can be completely recharged within 8 hours.
The end charge voltage will be higher than 2.6Vpc, which is good for active material exchange.

1.4 Disadvantage of Upper Constant Current Charge Model

It has risk of battery malfunction without voltage limited.
It isn't easy to manage charging in practice.

2. Practicable Daily Cyclic Performance

2.1 REXC(2V&12V) Series Cyclic Test Result



Graph 3, Cycle life vs. DOD of REXC(2V&12V) Series with Daily Cyclic Scenario

Table 3, data of cycle number

	Depth of Discharge/DOD			
	20%	40%	60%	80%
Cycle life	9400	4100	2400	1800

2.2 Discharge & Charge Scenario (80%DOD)

1) Cycle method: Discharge model is customizable, total discharge capacity is 80% DOD, charge with certain constant voltage and limited charge current which are recommended by manufacturer based on customer's discharge model, but charge time shall be 10 hours at least. This is one cycle.

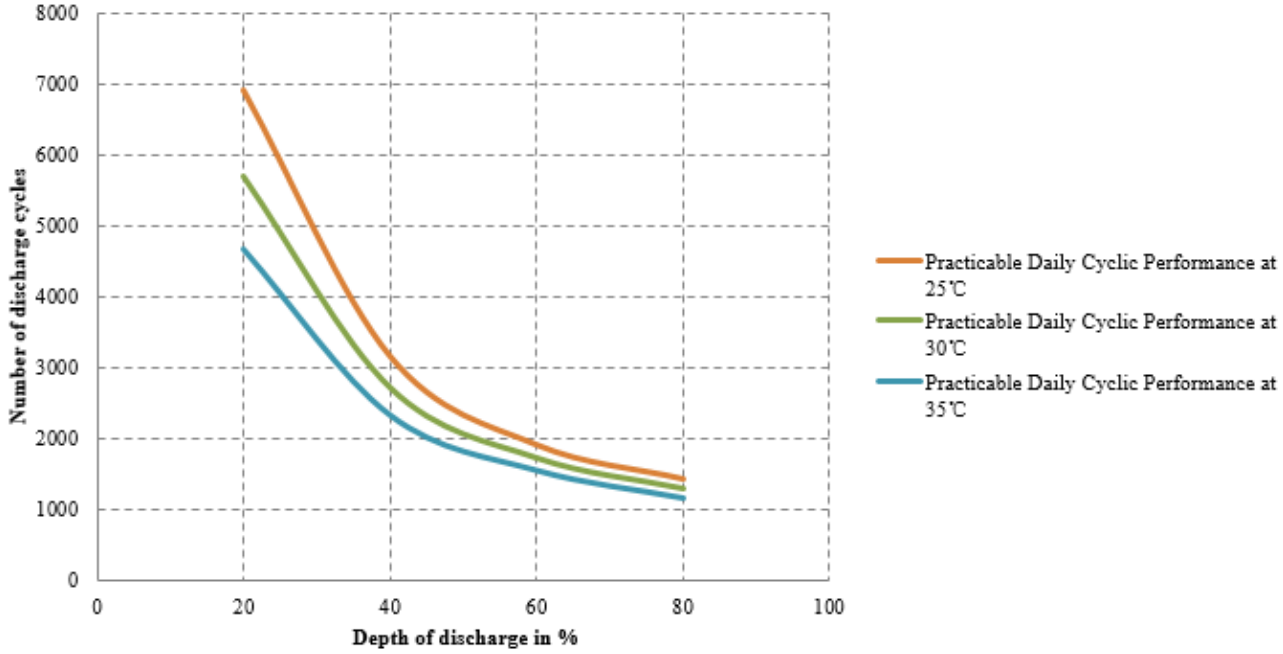
2) Battery failure determination: When the end voltage of daily discharge is lower than 1.80Vpc, battery is failed.
3) Temperature: 25℃

2.3 Upper Battery Cycle Life is Common Data

For practical daily cycle life, total charge & discharge time is constant of 24 hours. Different charge & discharge scenario will affect battery cycle life.

3. Practicable Daily Cyclic Performance vs. Ambient Temperature

3.1 REXC(2V&12V) Series Cyclic Test Result



Graph 4, Cycle life vs. DOD of REXC(2V&12V) Series with Daily Cyclic Scenario at Different Temperature

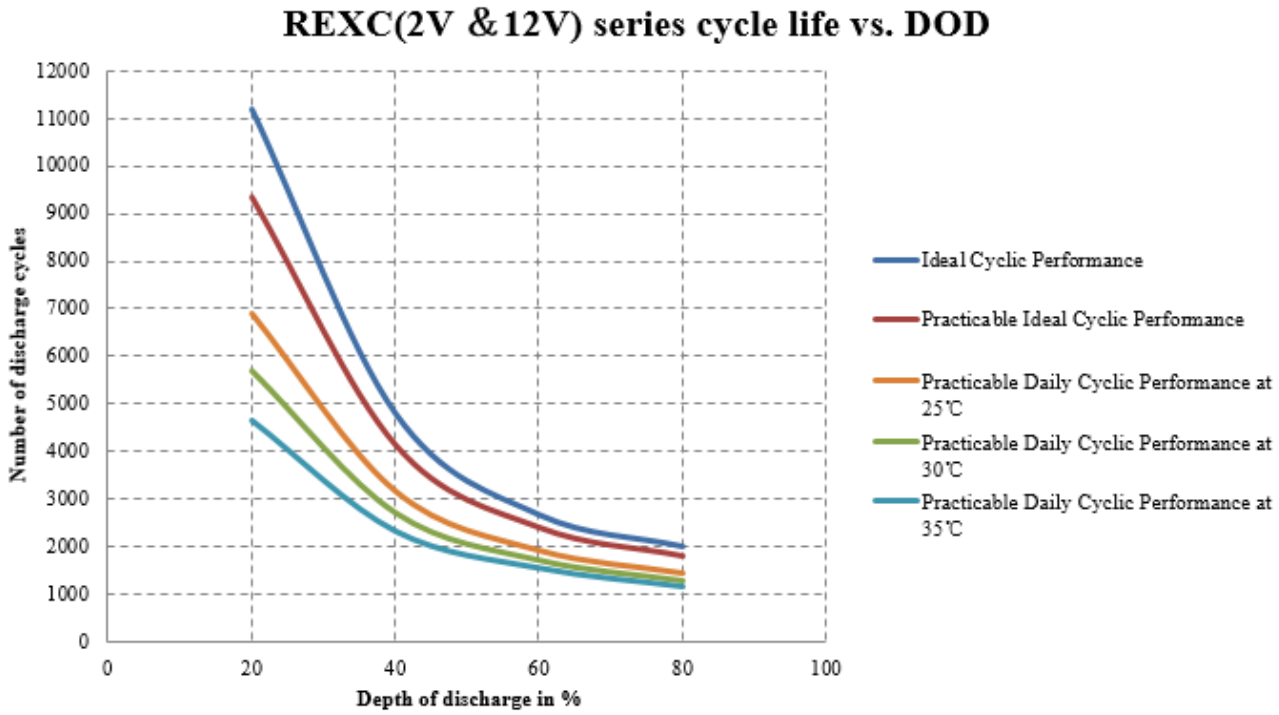
Table 4, data of cycle number

Cycle life	Depth of Discharge/DOD			
	20%	40%	60%	80%
25 °C	6900	3200	1900	1400
30 °C	5700	2700	1700	1300
35 °C	4700	2300	1600	1200

3.2 Affect of Ambient Temperature

VRLA is an electrochemical battery, absolutely will be affected by ambient temperature. High temperature harm to cyclic application is not so terrible as to floating application. High temperature accelerates battery secondary reaction to shorten battery cycle life.

4. Comparison of Cyclic Performance at different conditions



Graph 5, Comparison of Cycle life vs. DOD of REXC(2V&12V) Series with Different Conditions