Carbon based Power Capacitor Cell Specifications

1. Application Scope

This specification applies to carbon based power capacitor cells produced by Shenzhen Toomen New Energy Co., Ltd. Represented by Altreonic NV, Gemeentestraat 61A B1, 3200 Linden, Belgium

- TMDD1.0/3.2
- TMDD1.3/2.5
- TMMD4.0/4.0

2. Product Type

2.1. Product Type: Carbon based power capacitor Cell.
Further referred to as “powercapacitor cell” or “cell”.

2.2. Product Specifications:

- 1.0Ah/2000F/3.2VDC
- 1.3Ah/3300F/2.5VDC
- 4.0Ah/5000F/4.0VDC

3. Basic Parameters

			TMDD1.0/3.2/18500	**TMDD1.3/2.5/18650**	**TMMD4.0/4.0/23680**
			1.0Ah/2000F/3.2VDC	**1.3Ah/3300F/2.5VDC**	**4.0Ah/5000F/4.0VDC**
	Item	**Unit**	**Value**	**Value**	**Value**
1	Nominal capacity (discharged with the standard profile (< 1C))	Ah	1,05	1,25	4,00
2	Capacitance	F	2000	3300	5000
	Tolerance	%	5	5	5
3	Nominal energy (discharged with standard profile (<1C))	Wh	3,3	3,0	13,8
5	Nominal voltage	V	3,20	2,50	4,0
6	Charging mode		CC-CV	CC-CV	CC-CV
7	Maximum recommended charging voltage	V	3,40	2,70	4,20
8	Discharging cut-off voltage	V	2,50	1,80	2,80
9	Max. continuous charging current Max. C-rate	A C	3,00 3	15,0 12	5,00 1,25
10	Max. continuous discharging current Max. C-rate	A C	10,00 10	25,0 20	5,00 1,25

11	Allowable pulse discharging current (< 200 ms)	A	80	100	10
12	Max sustained power capability	W	32	62,5	18,5
13	Max. pulse power capability (<200 ms)	W	256	250	27
14	Max. Internal resistance	mOhm	20	13	20
15	Weight	g	30,0	39,0	60,0
	Weight tolerance	%	1,00	1,00	1,00
16	Diameter	mm	18,6	18,6	23,0
17	Height	mm	50,0	65,0	68,0
19	Recommended transportation voltage +/- 0,1V	V	3,2-3,4	2,3-2,5	3,5
20	Recommended storage voltage +/- 0,1V	V	3,2-3,4	2,3-2,5	3,50
21	Min. operation temperature	°C	-20	-40	-40
	Max. operation temperature	°C	+70	+80	+80
22	Min storage temperature	°C	-5	-5	-5
	Max. storage temperature	°C	35	35	35
23	Max. storage humidity	RH %	85	85	85
24	Gravimetric rated energy density	Wh/kg	100	80	260
25	Volumetric rated energy density	Wh/dm3	230	178	488
26	Power density	W/kg	1500	1500	260
27	Pulse power density (200 ms)	W/kg	8000	6000	520
28	Cycle life (charge/discharge cycles till 75%)		> 10000	> 20000	> 10000
29	Retained energy after 28 days	%	95	95	95
30	Short circuit temperature	°C	105	100	< 150
31	Guarantee period manufacturing	months	12	12	12
32	Fire Hazardous substances		The cell does not pose a fire or explosion risk.		
		* Custom designed packs: specifications might deviate. ** Cell damage possible outside these margins. Lower cut-off voltage allowed for 200 ms at C-rates > 1. *** Max. C-rating of powerpack is limited by selected cable parameters and can be lower than theoretical maximum derived from cell parameters			

4. Appearance

There must be no serious visual defects (damage, deformation, leakage, etc.) on the outer surface of the power capacitor cell, even when it does not affect the normal use of the cell.

5. Technical Requirements

5.1. Test Conditions

Unless specifically requested, the experiments shall be carried out under standard atmospheric conditions.

- Standard Temperature：25 ± 3℃
- Standard Humidity：65 ± 20%
- Atmospheric Pressure：86 kPa~106 kPa

5.2. Standard Charging Profile

Under the condition of ambient temperature (25 ±3)℃, charge the power capacitor cell with the maximum charging voltage under a 0.5A limited constant current until the charging current is less than or equal to 0.02A, then stop charging.

6. Performance Measurement

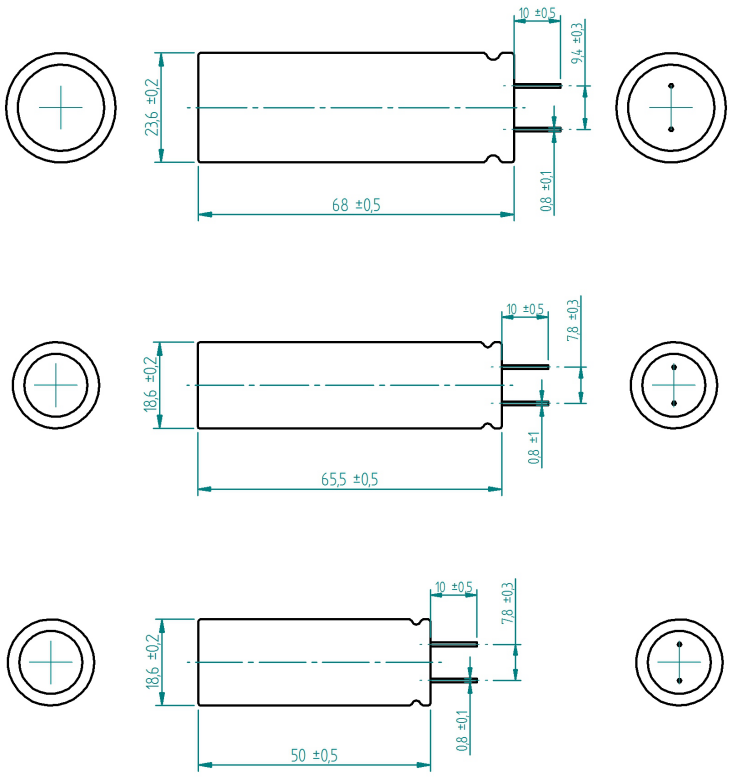
№	Item	Test Method	Required Result
1	Discharge characteristics	After the power capacitor cell is charged according to the standard charge profile (see 5.2), discharge to the final discharging voltage under the specified current at the ambient temperature of the (25± 3)℃	Capacity: ≥ 90% @ 50% of maximum allowed current ≥ 75% @ maximum allowed current
2	Cycle characteristics	After the power capacitor cell is charged according to the standard charge profile (see 5.2), hold it for 5 minutes, then discharge to the final discharging voltage under 0.2A at the ambient temperature of the (25± 3)℃ counting as 1 cycle. If after two consecutive discharge cycles the capacity is lower than 75% of the initial capacity, the cell is considered to be end of life.	Not less than 10000 times
3	Energy holding characteristics	After the power capacitor cell is charged according to the standard charge profile (see 5.2), keep the cell in storage for 28 days, then measure the discharging capacity of the power capacitor cell by discharging it to the final discharging voltage under 0.2A at the ambient temperature of (25± 3)℃. The recoverable capacity of the power capacitor cell is then tested according to the standard charge and discharge condition	Capacity: ≥ 95%

7. Safety and Environmental Specifications

№	Item	Test Method	Required Result
1	Short circuit	After the power capacitor cell is charged according to the standard charge profile (see 5.2), hold it for 24 hrs, then short circuit the positive and negative electrodes and monitor the temperature variation. When the temperature drops to 10℃ below the peak, end the experiment and check the appearance and temperature of	No fire, No explosion. The surface temperature of the cell is less than

		the cell under test.	150℃.
2	Overcharging	After the power capacitor cell is charged according to the standard charge profile (see 5.2), keep charging the cell voltage at 10V under 1A, then switch to constant voltage charging until the charging current drop to 5 mA and check the visual appearance.	No fire, No explosion
3	Hammer Impact	The cell is placed on the impact table and a 10kg hammer drops freely from a height of 1m impacting the cell under test that has been fixed in the fixture.	No fire, No explosion. Deformation is allowed.
4	High Temperature Performance	After the power capacitor cell is charged according to the standard charge profile (see 5.2), hold it for 2 hrs at the ambient temperature of (55±2)℃, then discharge to the final discharging voltage under 0.8A, measure the discharging time; after that hold it for 2 hrs at the ambient temperature of (25±3)℃, and check the visual appearance.	No obvious deformation, no burst; Discharging time: ≥51min
5	Low Temperature Performance	After the power capacitor cell is charged according to the standard charge profile (see 5.2), hold it for 16～24 hrs at the ambient temperature of (-20 ± 2)℃, then discharge to the final discharging voltage under 0.2A and measure the discharging time. After that hold it for 2 hrs at the ambient temperature of the (25±3)℃, and check the visual appearance.	No obvious deformation, no burst. Discharging time: ≥180min
6	Vibration	After the power capacitor cell is charged according to the standard charge profile (see 5.2), fix the cell by fixture on the shaking table, adjust the vibration frequency and corresponding amplitude, along X, Y, Z three mutually perpendicular directions under 10 Hz ~ 55 Hz vibration frequency; vibration current I: 60%; vibration time T: 30 minutes.	No fire; No liquid leakage; No obvious damage or explosion
7	Drop	After the power capacitor cell is charged according to the standard charge profile (see 5.2), it is dropped from 10.0m height onto a 20 mm thick hardwood plate, in each of X, Y and Z directions of the cell.	No fire; No liquid leakage; No rupture or explosion
8	Puncture	After the power capacitor cell is charged according to the standard charge profile (see 5.2), quickly pierce the longitudinal axis of the cell by a steel needle of Φ 2.5mm~5mm, and leave the steel needle in the cell for 6hrs.	No fire, No explosion, Leakage and exhaust is allowed.
9	Constant humidity and heat	After the power capacitor cell is charged according to the standard charge profile (see 5.2, shelve it for 48 hrs in a constant temperature and humidity box with a temperature of (40 ± 2)℃ and relative humidity of (90% ~ 95%), take it out and hold it at the ambient temperature of (25±3)℃. Check the visual appearance; then discharge to the final discharging voltage under 1A.	No apparent deformation, no smoke or explosion; Discharging time: ≥ 36min

8. Dimensions of the carbon based power capacitor Cells



9. Guarantee Period

The expiration date of the guarantee period is 12 months from the production data at the factory.

10. Capacitor pin soldering process requirements

Short circuit of the positive and negative electrodes while the cells are in use or during the welding process is to be avoided. The temperature of the soldering station must be set at 300~320 ℃. The welding time must be less than 3 seconds. Avoid unnecessary movements of the electrode contacts.

11. Disclaimer

11.1. The company shall not be liable for any problems arising from the use of the hybrid carbon-based power capacitor cell outside its specifications.
11.2 The company does not assume any responsibility for products beyond the quality guarantee period.
11.3. The company is not responsible for the damage caused by the customer's acceptance tests or during damage caused by any assembly process.

12. Packaging

Carbon-based power capacitor cells should be in a 30 to 50% charge state when packaged. The packaged products should be placed in a dry, dust-free and moisture-free box. The batch number, specifications and models, nominal voltage and quantity should be marked on the outside the packing box.

13. Transportation

Carbon-based power capacitor cells should be packed in boxes for transportation. During transportation, they should be protected from violent vibrations, shocks or extrusion, sunshine and rain. They can be transported by vehicles, trains, ships and airplanes.

14. Storage

Carbon-based power capacitor cells should be stored in clean, dry and ventilated rooms with an ambient temperature as stipulated in item 5.1 and a relative humidity not exceeding 75%. Contact with corrosive substances is to be avoided and cells have to be kept away from fire and heat sources. In addition, the power capacitor cell must be stored in a half charge state to prevent over-discharge caused by self-discharge and potentially resulting in irreversible capacity loss.

15. Safety points of attention.

15.1. Never reverse the polarity when charging.
15.2. Never cause a direct short circuit between the positive and negative electrodes of the power capacitor cell.
15.3. When a power capacitor cell is not used or stored for a long time, charge the power capacitor cell before use.
15.4. Before testing or using the power capacitor cell, please read this specification carefully to prevent improper operation of the power capacitor cell resulting in failure, loss of function, heating, leakage, fire or even explosion.
15.5. When charging and discharging the power capacitor cell, only use adequate testing equipment. In particular, it is strictly forbidden to use standard constant-current constant-voltage sources and other equipment that cannot limit the voltage and current when charging and discharging the power capacitor cell, to avoid overcharging and over discharging of the power capacitor cell that can cause malfunction, failure or can result in a safety hazard.
15.6. When charging and discharging the cell or assembling it into the equipment, be careful not to reverse the positive and negative electrodes of the cell, otherwise the cell will instantaneously overcharge and over discharge, leading to serious failure of the cell.
15.7. Do not directly weld onto the cell body, do not dissect the cell.
15.8. Do not put cell in a pocket or bag with necklaces, hairpins, coins, screws or other metal objects. Do not store cells with any of the above items. Do not use metal or other conductive materials to directly connect the positive and negative electrodes of cell, resulting in a short circuit of cell. If needed, use an insulator to prevent accidental contact with the cell electrodes.
15.9. Do not knock, throw or step on a cell, nor put the cell into washing machine or high pressure equipment.
15.10. Do not place the power capacitor cell close to a heat source, such as a fire, heater, etc. Do not use or store the power capacitor cell in the hot sun or under the condition of ambient temperature exceeding 60℃. Otherwise, it may cause the power capacitor cell to heat, fire and malfunction.
15.11. Do not put the power capacitor cell into water or humid environment. When not in use for the time being, please put it in a low temperature and dry environment.
15.12. When it is observed that cell during use, testing when in storage, are hot, give off a smell, are discoloured, are deformed or look out of the ordinary, then the cell should be isolated immediately, disconnected if needed and if possible removed to a safe area.
15.13 If the electrolyte of a cell leaks and accidentally splashes into the eyes, do not rub the eyes, and immediately wash with clean water. If needed, go to a medical facility. When skin or clothing is contaminated with electrolyte, immediately wash away with clean water.

16. Contact point

For Europe:

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17. Manufacturer

Shenzhen Toomen New Energy Co., Ltd