		DATE: 28/07/2020

Lithium Ion Battery Pack

Specification

MODEL MGL9050

Prepared By/Date	Checked By/Date	Approved By/Date
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Customer Approval	**Signature/Date**
	Company Name
	Company Stamp

Amendment Records

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1 Scope

This specification is applied to the reference battery in this Specification

2 Product Specification

Table 1

No.	Item	General Parameter		Remark
1	Rated Capacity	Typical	700mAh	Standard discharge（0.2C) after Standard charge
		Minimum	670mAh	
2	Nominal Voltage	3.7V		Mean Operation Voltage
3	Voltage at end of Discharge	2.75V		Discharge Cut-off Voltage
4	Charging Voltage	4.2V		IEC standard
5	Internal Impedance	≤180mΩ		Internal resistance measured at AC 1KH$_Z$ after 50% charge The measure must uses the new batteries that within one week after shipment and cycles less than 5 times
6	Standard charge	Constant Current 0.5C Constant Voltage 4.2V 0.01C cut-off		Charge time : Approx 4h
7	Standard discharge	Constant current 0.2C end voltage 2.75V		

Continuous the table 1

No.	Item	General Parameter	Remark
8	Maximum Continuous Discharge Current	1A	Limited by PCB
9	Operation Temperature Range	Charge : 0~45℃	60±25%R.H. Bare Cell
		Discharge: -10~60℃	
10	Storage Temperature Range	Less than 1 year: -20~25℃	60±25%R.H. at the shipment state
		less than 3 months: -20~40℃)	
		Less than 7 day : -20~65℃	
11	Weight	Approx : 16g	FYI
12	Max. Pack Dimensions	Length 43.0mm	
		Width : 31.0mm	
		Thickness : 7.5mm	

3 Performance And Test Conditions

3.1 Standard Test Conditions

Test should be conducted with new batteries within one week after shipment from our factory and the cells shall not be cycled more than five times before the test. Unless otherwise specified, test and measurement shall be done under temperature of 20±5℃ and relative humidity of 45~85%. If it is judged that the test results are not affected by such conditions, the tests may be conducted at temperature 15~30℃ and humidity 25~85%RH.

3.2 Measuring Instrument or Apparatus 3.2.1 Dimension

The dimension measurement shall be implemented by instruments with equal or more precision scale of 0.01mm.

3.2.2 Voltmeter

Standard class specified in the national standard or more sensitive class having inner impedance more than 10kΩ/V

3.2.3 Ammeter

Standard class specified in the national standard or more sensitive class. Total external resistance including ammeter and wire is less than 0.01Ω.

3.2.4 Impedance Meter

Impedance shall be measured by a sinusoidal alternating current method (1kHz LCR meter).
（1kHz LCR）。 3.3 Standard Charge\Discharge

3.3.1 Standard Charge ： Test procedure and its criteria are referred as follows:

0.5C=350mA

Charging shall consist of charging at a 0.5C constant current rate until the battery reaches 4.2V. The battery shall then be charged at constant voltage of 4.2V while tapering the charge current. Charging shall be terminated when the charging current has tapered to 0.01C. Charge time: Approx 4hrs, The battery shall demonstrate no permanent degradation when charged between 0 ºC and 45 ºC.

3.3.2 Standard Discharge

0.2C=140mA

The battery shall be discharged at a constant current of 0.2C to 2.75V @ 20º ± 5C0.2C 2.75V @ 20º ±5C

3.3.3 If no otherwise specified, the rest time between Chare and Discharge amount to 30min.

3.4 Appearance

There shall be no such defect as flaw, crack, rust, leakage, which may adversely affect commercial value of battery.

3.5 Initial Performance Test

Table 2

Item	Test Method and Condition	Requirements
(1) Open-Circuit Voltage	The open-circuit voltage shall be measured within 24 hours after standard charge.	≥4.0V
(2) Internal impedance	Internal resistance measured at AC 1KHz after 50% charge.	≤180mΩ
(3) Minimal Rated Capacity	The capacity on 0.2C discharge till the voltage tapered to 2.75V shall be measured after rested for 30min then finish standard charge.	Discharge Capacity ≥670mAh

3.6 Temperature Dependence of discharge capacity

Batteries shall be charged per 3.3.1 and discharged @0.2Cto 2.75V. Except to be discharged at temperatures per Table 3. Batteries shall be stored for 3 hours at the test temperature prior to discharging and then shall be discharged at the test temperature. The capacity of a cell at each temperature shall be compared to the capacity achieved at 23 ºC and the percentage shall be calculated. Each battery shall meet or exceed the requirements of Table 3.

Table 3

Discharge Temperature	-10℃	0℃	23℃	60℃
Discharge Capacity （0.2C）	40%	70%	100%	95%

3.7 Cycle Life and Leakage-Proof

Table 4

No.	Item	Criteria	Test Conditions
1	Cycle Life	Higher than 80% of the Initial Capacities of the Cells	Carry out 300 cycles Charging/Discharging in the below condition. ◆Charge: Charge at 0.5C/4.2V for about 4hrs ◆Discharge: 0.5C to 2.75 V ◆Rest Time between charge/discharge: 30min. ◆Temperature : 20±5℃300 ◆ 0.5C/4.2V ◆0.5C 2.75V ◆30min. ◆20±5℃
2	Leakage-Proof	No leakage (visual inspection)	After full charge with standard charge, store at 60±3℃, 60±10%RH for 1 month.

4. Mechanical characteristics and Safety Test

Table 5 (Mechanical characteristics)

No.	Items	Test Method andCondition	Criteria
1	Vibration Test	After standard charging, fixed the cell to vibration table and subjected to vibration cycling that the frequency is to be varied at the rate of 1Hz per minute between 10Hz an 55Hz, the excursion of the vibration is 1.6mm. The cell shall be vibrated for 30 minutes per axis of XYZ axes.	No leakage No fire
2	Drop Test	The battery is to be dropped from a height of 1 meter twice onto concrete ground.	No explosion, No fire, no leakage.

Table 6 (Safety Test)

Item	Battery Condition	Test Method	Requirements
Crush	Fresh, Fully charged	Crush between two flat plates. Applied force is about 13kN(1.72Mpa) for 30min.	No explosion, No fire
Short Circuit 20℃）	Fresh, Fully charged	Each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1Ω.Tests are to be conducted at room temperature (20±2℃).	No explosion, No fire The Temperature of the surface of the Cells are lower than 150℃
Short Circuit 60℃）	Fresh, Fully charged	Each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1Ω.Tests are to be conducted at temperature(60±2℃).	No explosion, No fire The Temperature of the surface of the Cells are lower than 150℃
Impact	Fresh, Fully charged	A 56mm diameter bar is inlayed into the bottom of a 10kg weight. And the weight is to be dropped from a height of 1m onto a sample battery and then the bar will be across the center of the sample.	No explosion, No fire
Forced Discharge	Fully charged cell	Discharge at a current of 1C for 2.5hrs.	No explosion, No fire
Nail Pricking (3mm)	Fresh, Fully charged	Prick through the sample battery with a nail having a diameter of 3mm and remain 2h.	No explosion, No fire

5. Protection circuit Parameters

Item	Symbol	Content	Criterion
Over charge Protection	V_{DET1}	Over charge detection voltage	4.325±0.025V
	tV_{DET1}	Overcharge detection delay time	0.15~4.6S
	V_{REL1}	Over charge release voltage	4.075±0.025V
Over discharge protection	V_{DET2}	Over discharge detection voltage	2.5±0.05V
	tV_{DET2}	Over discharge detection delay time	36~290mS
	V_{REL2}	Over discharge release voltage	Need recharge to release
Overcurrent protection	V_{DET3}	Over current detection voltage	0.15±0.015V
	I_{DP}	Over current detection current	2~4.5A
	tV_{DET3}	Detection delay time	4.5~18mS
		Release condition	Cut load
Short protection		Detection condition	Cut short circuit
	T_{SHORT}	Detection delay time	220~380μS
		Release condition	Cut short circuit
Interior resistance	R_{DS}	Main loop electrify resistance	< 60mΩ
Current consumption	I_{DD}	Current consume in normal operation	2μA Type 6μA Max

6. CAUTIONS IN USE

To ensure proper use of the battery please read the manual carefully before using it.

. Handling

- Do not expose to, dispose of the battery in fire.
- Do not put the battery in a charger or equipment with wrong terminals connected.
- Avoid shorting the battery
- Avoid excessive physical shock or vibration.
- Do not disassemble or deform the battery.
- Do not immerse in water.
- Do not use the battery mixed with other different make, type, or model batteries.
- Keep out of the reach of children.

. Charge and discharge

- Battery must be charged in appropriate charger only.
- Never use a modified or damaged charger.
- Do not leave battery in charger over 24 hours.

. Storage

- Store the battery in a cool, dry and well-ventilated area.

. Disposal

- Regulations vary for different countries. Dispose of in accordance with local regulations.

7 Battery operation instruction

7.1 Charging

Charging current：Cannot surpass the biggest charging current which in this specification book stipulated。

Charging voltage：Does not have to surpass the highest amount which in this specification book stipulated to decide the voltage。

Charge temperature：The battery must carry on the charge in the ambient temperature scope which this specification book stipulated。

Uses the constant electric current and the constant voltage way charge, the prohibition reverse charges. If the battery positive electrode and the cathode meet instead, can damage the battery。

7.2 Discharging current

The discharging current does not have to surpass this specification book stipulation the biggest discharging current, the oversized electric current electric discharge can cause the battery capacity play to reduce and to cause the battery heat。

7.3 Electric discharge temperature

The battery discharge must carry on in the ambient temperature scope which this specification book stipulated.

7.4 Over-discharges

After the short time excessively discharges charges immediately cannot affect the use, but the long time excessively discharges can cause the battery the performance, battery function losing. The battery long-term has not used, has the possibility to be able to be at because of its automatic flashover characteristic certain excessively discharges the condition, for prevented excessively discharges the occurrence, the battery should maintain the certain electric quantity。

7.5 Storing the Batteries

The battery should store in the product specification book stipulation temperature range. If has surpasses above for six months the long time storage, suggested you should carry on additional charge to the battery。

8. Period of Warranty

The period of warranty is a year from the date of shipment. We guarantees to give a replacement in case of cells with defects proven due to manufacturing process instead of the customers abuse and misuse.

9. Other The Chemical Reaction

Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage. If the batteries cannot maintain a charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery.

10. Note: Any other items which are not covered in this specification shall be agreed by both parties.