

# Specification Approval Sheet

|                       |                                 |
|-----------------------|---------------------------------|
| <b>Product No.</b>    | MEGOLF12220-12.8V22Ah-A1        |
| <b>File Name</b>      | Specification of 4S7P-12.8V22Ah |
| <b>File Version</b>   | A1                              |
| <b>File No.</b>       | PR- WI-RD-001                   |
| <b>Controlled No.</b> |                                 |
| <b>Date</b>           | 2017-03-16                      |

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|-------------------|---------|----------|
| Draft             | Checked | Approval |
|                   |         |          |
| Customer Approval |         |          |

## 1 Scope

This document describes the Product Specification of the Lithium-ion rechargeable battery supplied by Tempel Group.

## 2 Specifications

### 2.1 Battery Specification

| No. | Items                      | Specification            | Note                                  |
|-----|----------------------------|--------------------------|---------------------------------------|
| 1   | Nominal voltage            | 12.8V                    | Open Circuit Voltage :<br>13.2V~13.6V |
| 2   | Nominal capacity           | 22Ah                     | 0.2C                                  |
|     | Minimum capacity           | 22Ah                     |                                       |
| 3   | Initial impedance          | $\leq 200\text{m}\Omega$ | AC 1KHz after standard Charge         |
| 4   | Charge voltage             | 14.6V                    |                                       |
| 5   | Discharge cut-off voltage  | 8V                       |                                       |
| 6   | Standard charge current    | 4.4A                     | 0.2C                                  |
| 7   | Max. charge current        | 5A                       |                                       |
| 8   | Standard discharge current | 4.4A                     | 0.2C                                  |
| 9   | Max. discharge current     | 22A                      |                                       |
| 10  | Peak discharge current     | 66A                      | time $\leq 10\text{S}$                |
| 11  | Operating temperature      | 0°C ~ +45°C              | Charge                                |
|     |                            | -20°C~ +55°C             | Discharge                             |
| 12  | weight                     | About 2.8kg              |                                       |
| 13  | Dimension                  | L*W*H: 168*128*102mm     |                                       |

## 2.2 Common Performance

| No | Items                            | Testing method and determinant standard   |
|----|----------------------------------|---|
| 1  | Charge Performance               | The standard charge mode: under the temperature of $23\pm 2^{\circ}\text{C}$ , charge the battery with the current of 0.2C until the voltage reaches up to 14.6V, then charge with constant voltage until the charge current $\leq 0.02\text{C}$ , then stop charging.<br>。   |
| 2  | Discharge Performance            | When connecting with load, the battery can supply power. Charge the battery with standard charge mode, then rest for 0.5h, then discharge with 0.2C until the voltage is 8V, and the discharge time is required $\geq 5\text{h}$ .  |
| 3  | High Temperature Characteristics | Standard charge the battery, then put the battery into the constant temperature and humidity oven with $55\pm 2^{\circ}\text{C}$ , then discharge with 0.2C to 8V. The discharge time is required $\geq 4.7\text{h}$ (95%) and the battery should no deformation and smoking.   |
| 4  | Low Temperature Characteristics  | Standard charge the battery, then put the battery into the constant temperature and humidity oven with $-20\pm 2^{\circ}\text{C}$ , then discharge with 0.2C to 8V. The discharge time is required $\geq 2.5\text{h}$ (50%) and the battery should no deformation and smoking.  |
| 5  | Cycle Performance                | Under the temperature of $23\pm 2^{\circ}\text{C}$ , charge the battery with 0.2C, when the voltage reaches up to 14.6V charge with constant voltage until the charge current $\leq 0.02\text{C}$ , then stop charging, then rest for 0.5h, then discharge with 0.2C to 8V. Cycle with the above mode, the test shall be terminated when Discharging Capacity $< 80\%$ of Initial Capacity in three consecutive cycles. The cycle life is required $\geq 2000$ times. |
| 6  | Charged Storage Characteristics  | Charge the battery with 0.5C, then shift to charge with constant voltage until the voltage reaches up to 14.6V, when the charge current $\leq 0.02\text{C}$ stop charging; rest under the temperature of $23\pm 2^{\circ}\text{C}$ for 28 days then discharge with 0.5C to 8V. The discharge time is required $\geq 1.8\text{h}$ (90%) .  |

## 2.3 Safety Performance

| No | Items               | Testing method and determinant standard  |
|----|---------------------|--|
| 1  | Short Circuit       | After charge batteries, place at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 1h. Short the battery for 10min, the external circuit resistance should be less than $5\text{m}\Omega$ . No explosion, No fire .   |
| 2  | Vibration Test      | When charges fully, the fixed cell to will vibrate the table and the clothing from will change to the circulation vibrational frequency by 1Hz rate each minute between 10 Hz 55Hz, the vibration tour will be 1.15mm. The cell will vibrate in each XYZ axis 90 minutes. No leakage, Capacity recovery rate 90% ( standby 3hours ) .No explosion, No fire . |
| 3  | Over-discharge test | Charge the battery. Place at $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 1h, then discharge in $1/3\text{C}$ current at same temperature until some cell's voltage is 0V(if there are electronic protection circuit, remove it temporarily). No explosion, No fire .  |
| 4  | Over-charge test    | Charge in accordance with the following two ways (Choosing one between the twos). Charge at 1C current for 90min or until voltage of some single battery reaches 5V (stop test when fulfills either condition).  |

### 3 product circuit diagram 产品线路图

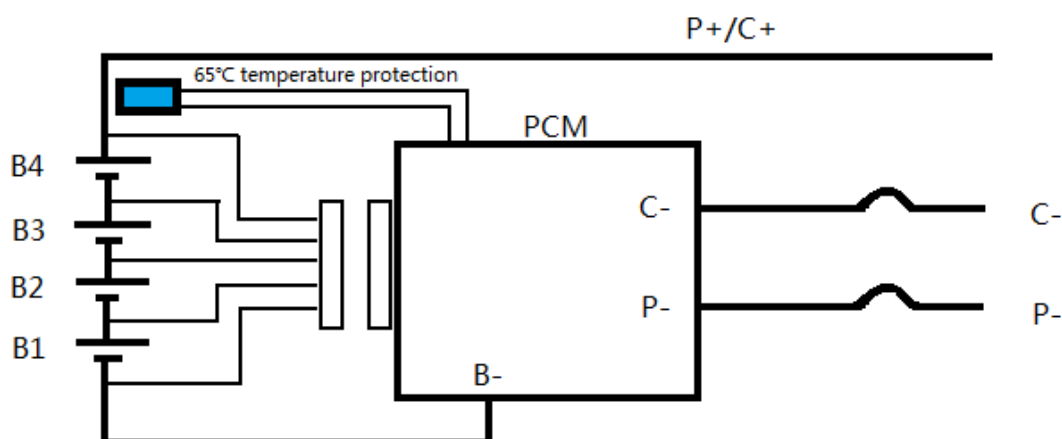


figure 1/ 1

#### 4 PCM Electrical Characteristic (adjust)

| No. | Items                                     | Standard                          | Remarks                          |
|-----|---|-----------------------------------|----------------------------------|
| 1   | Over-charge voltage protection            | $3.8 \pm 0.05V$                   |                                  |
| 2   | Over-charge detection delayed time        | 0.5~2S                            |                                  |
| 3   | Over-charge voltage protection release    | $3.6 \pm 0.1V$                    |                                  |
| 4   | Over-discharge voltage protection         | $2.0 \pm 0.1V$                    |                                  |
| 5   | Over-charge detection delayed time        | 10-200mS                          |                                  |
| 6   | Over-discharge voltage protection release | $2.3 \pm 0.1V$                    |                                  |
| 7   | Continuous operating current              | $\leq 30A$                        |                                  |
| 8   | Temprature protection                     | $65 \pm 5^{\circ}C$               |                                  |
| 9   | Over-current protection                   | $90 \pm 10A$                      | Protection release: Cut off load |
| 10  | Detection delayed time                    | 10ms (max)                        |                                  |
| 11  | Short-circuit protection                  |                                   | Protection release: Cut off load |
| 12  | Mode                                      | Charge balance                    |                                  |
| 13  | Current Consumption                       | $\leq 200 \mu A$                  |                                  |
| 14  | Operating Temperature                     | $-40^{\circ}C \sim -85^{\circ}C$  |                                  |
| 15  | Storage Temperature                       | $-40^{\circ}C \sim -125^{\circ}C$ |                                  |

## 5 Configuration

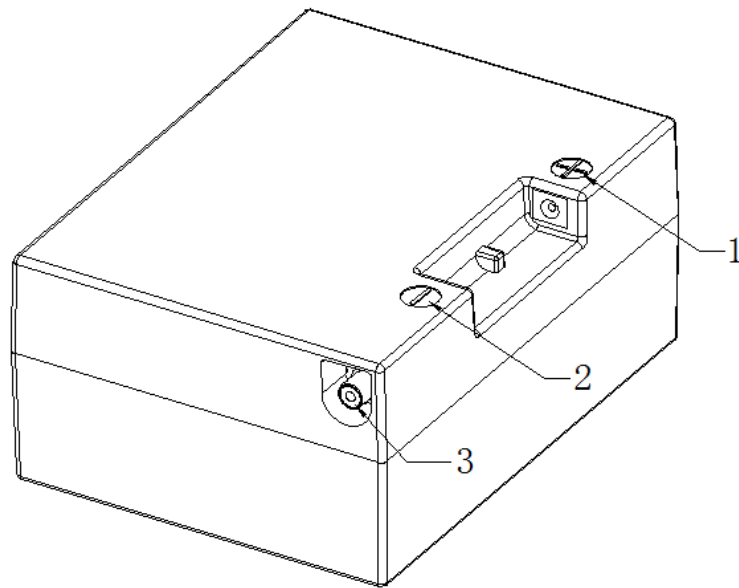


figure2/ 2



figure3/ 3

| NO. | interface explanation |  |
|-----|-----------------------|--|
| 1   | Discharge Positive    |  |
| 2   | Discharge Negative    |  |
| 3   | Charge Port           |  |
| 4   | Discharge wire        |  |

## 6 Test Requirement

### 6.1 Standard test condition

Battery Pack to be tested should be new battery pack within one month after shipment from our factory and the battery pack should not be cycled more than five times before the test. Unless otherwise specified, test and measurement should be done under these conditions:

Temperature : 15°C~25°C

Relative Humidity : 45%~85%RH

Atmospheric Pressure : 86kPa~106kPa

### 6.2 Measuring equipment implementation requirements

1.Dimension Measurement Instrument:

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

2. Battery test system should have current accuracy within  $\pm 0.1\%$ , voltage accuracy within  $\pm 0.5\%$  & time accuracy within  $\pm 0.1\%$ .

3. Temperature measurement accuracy of instruments should be within  $\pm 0.5\text{ }^{\circ}\text{C}$ .

4. Standard class specified in national standard or more sensitive class, with internal impedance not less than 10 K $\Omega$ .

5. Standard class specified in national standard or more sensitive class. Total resistance including ammeter and wire is less than 0.01 $\Omega$ .

6. Impedance shall be measured by a sinusoidal alternating current method (AC 1kHz LCR). Resistance is not a constant value according to the change of temperature and state of charge, and related to lead length and capacity.

7. All test equipment and measuring instruments should be passed inspection of calibration organization.

### 6.3 Appearance Test Standard

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

## 7 Storage and Shipment Requirement

| Item                |                                   | Criteria   |
|---------------------|-----------------------------------|------------|
| Storage temperature | Short period(less than 1 month)   | -10°C~45°C |
|                     | Medium period (less than 3 month) | -10°C~35°C |
|                     | Long period (more than 3 month)   | 0°C~30°C   |
| Relative Humidity   |                                   | ≤75% RH    |
| State of Charge     |                                   | 40%~60%    |

Battery pack must be charged every three months when long term storage, please charge the battery pack with standard charging current for 0.5h~1h to keep 40%~60% state of charge.

## 8 Warning and Caution

- 1) Do not connect the battery pack's positive (+) and negative (-) poles reversed to charger or load, Do not connect the battery pack to charger's input power source (AC power supply).
- 2) Do not let the battery pack's terminals (+ and -) contact with unnecessary wire or any metal or stored them together, that may cause the battery pack short-circuit.
- 3) Do not drive a nail in battery pack, hit the battery pack with a hammer, stamp on or throw the battery pack.
- 4) Do not disassemble or alter the batteries' outside structure.
- 5) Do not use the battery pack under blazing sun, otherwise may cause battery pack overheating then catch fire or disable.
- 6) Do not put the battery pack into fire or heat the battery pack; do not store the battery pack in high temperature environment
- 7) Do not submerge the battery pack in water or get wet in the rain, keep the battery in shady and cool place when stored.
- 8) Do not charge the battery continuously over 24 hour.
- 9) When charging or discharging the battery pack, if you find any abnormal smell or noise, you must stop the charging or discharging at once, and contact the factory.

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10) When using the battery pack out of range of 0~50°C, the capacity may decrease, that doesn't mean the battery pack was failure.

## 9 Product liability

Consumers must comply with the requirements of the specifications strictly using the battery. Due to misuse may cause the battery overheating, fire or explosion, for no operation in accordance with the specification as a result of any accident, Poweroad Renewable Energy Ltd. not negative any responsibility.

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