APPROVAL SPECIFICATION

Lithium Ion Rechargeable cell

Model : ETI58253172 F20B

	Approved

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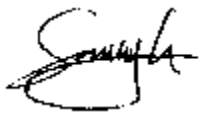
Enertech International, Inc.			

Revision History

Revision No	Date	Contents	Remark
0.0	19. Mar. 2024	Initial Release (ETI58253172 F20B)	

CONTENTS

1. Scope

This specification defines the characteristics of a Lithium Ion Rechargeable Cell manufactured by **ENERTECH INTERNATIONAL INC.**

2. Description and Model

2.1 Description Lithium Ion Rechargeable Cell
2.2 Model ETI58253172 F20B

3. Nominal Specifications

Item		Specification
3.1 Capacity	Nominal	20.0Ah
	Minimum	19.7Ah
3.2 Energy density	Volumetric	258Wh/L
	Gravimetric	137Wh/kg
3.3 Nominal Voltage		3.2V
3.4 Operating Voltage Range		2.5V ~ 3.65V
3.5 Standard	Charge Current	10.0A (0.5C)
	Discharge Current	10.0A (0.5C)
3.6 Maximum[1)]	Charge Current	60.0A (3.0C)
	Discharge Current	60.0A (3.0C)
	Peak Discharge	100.0A (5.0C) (≤ 10sec)
3.7 Operating Temperature[2) 3) 4)]	Charge	-20℃ ~ 45℃
	Discharge	-20℃ ~ 55℃
3.8 Storage Temperature	0 ~ 25°C	≤ 1Year
	0 ~ 45°C	≤ 3Month
	-20 ~ 55°C	≤ 1Month
3.9 Storage Humidity		45 ~ 85%RH
3.10 Cell size	Thickness	5.8 ±0.2mm (Initial fully charged Cell)
	Width	253.0 ±1.0mm
	Length	172.0 ±1.0mm
3.11 AC Impedance		Max. 3.0mΩ
3.12 Weight		Max. 500.0g

1) The maximum current is not for the continuous cycle condition, only check the cell performance.
2) The operation temperature range for the continuous cycle condition is 10 ~ 40°C.
3) The surface temperature of cell must also be within '3.7 operating temperature range'.
4) Cell is still usable at '-30 ~ -10°C' and '40 ~ 55°C' on an infrequent base and be used with reduced performance.
But, the continuous cycle condition at '-30 ~ -10°C' and '40 ~ 55°C' could significantly degrade performance and cause safety issues.
If used at '-30 ~ -10°C', it should be used at a low current (0.2C) and under the 10th/year.
5) Shipping state: 30±5% capacity of fully charged state

4. Outline Dimensions

See the attachment **(A. Out view drawing for ETI58253172 F20B)**

5. Appearance

There shall be no such defects as scratch, rust, discoloration, leakage which may adversely affect commercial value of the cell.

6. Standard Test Conditions

6.1 Environmental condition
Unless otherwise specified, all tests stated in this specification are conducted at temperature 25 ±3°C and humidity 65 ±20%.

6.2 Measuring Equipment
(1) Ammeter and voltmeter
The ammeter and voltmeter should have an accuracy of the grade 0.5 or higher.
(2) Slide caliper
The slide caliper should have 0.05mm scale.
(3) Impedance meter
The impedance meter with AC 1 kHz should be used.

7. Characteristics

7.1 Standard Charge
This "Standard Charge" means charging the cell with charge current 0.5C and constant voltage of 3.65V until charge current reach to 0.05C at 25 ±3°C

7.2 Standard Discharge Capacity
The standard discharge capacity is defined as the initial discharge capacity of the cell, which is measured with limiting 0.5C discharge to 2.5V at 25 ±3°C within 1 hour after the standard charge.

Standard discharge capacity ≥ 19.7Ah

7.3 Initial Internal Impedance
Initial internal impedance of the cell measured at AC 1kHz after standard charge.

Initial internal impedance ≤ 3.0mΩ

7.4 Charge Rate Capabilities
Capacity is measured with the various currents under the table and 3.65V 0.05C cut-off after the standard discharge.

Items	Charge Condition			
Current	0.3C	0.5C	1.0C	1.5C
Relative Capacity	100%	95%	92%	90%

Note: Percentage as an index of the standard discharge capacity (=19.7Ah) is 100%.

7.5 Discharge Rate Capabilities

Capacity is measured with the various currents under the table and 2.5V cut-off after the standard charge.

Items	Discharge Condition		
Current	0.5C	1.0C	2.0C
Relative Capacity	100%	95%	90%

Note: Percentage as an index of the standard discharge capacity (=19.7Ah) is 100%.

7.6 Temperature Dependence of Discharge Capacity

Capacity comparison at each temperature, measured with discharge constant current 0.5C and 2.5V cut-off after the standard charge is as follows

Charge Temperature	Discharge temperature			
25 ±3°C	-20 ±3°C	0 ±3°C	25 ±3°C	55 ±3°C
Relative Capacity	20%	60%	100%	100%

Note: If charge temperature and discharge temperature is not the same, the interval for temperature change is 3 hours. Percentage as an index of the standard discharge capacity (=19.7Ah) is 100%.

7.7 Temperature Dependence of Charge Capacity

Capacity comparison at each temperature, measured with charge constant current 0.5C and 3.65V 0.05C cut-off after the standard discharge is as follows.

Discharge Temperature	Charge temperature			
25 ±3°C	-20 ±3°C	0 ±3°C	25 ±3°C	55 ±3°C
Relative Capacity	50%	80%	100%	100%

Note: If charge temperature and discharge temperature is not the same, the interval for temperature change is 3 hours. Percentage as an index of the standard discharge capacity (=19.7Ah) is 100%.

7.8 Cycle Life

Each cycle is an interval between the standard charge and the discharge (discharge current, 0.4C) with 2.5V cut-off.
Capacity is measured at 1200cycles.

1200cycle Capacity ≥ 16.00Ah (80% of the standard discharge capacity)

7.9 Storage Characteristics

Capacity after storage for 30days at 25 ±3°C. After the standard charged, measured with standard discharge at 25 ±3°C.

Capacity retention (after the storage) ≥ 18.00Ah (90% of the standard discharge capacity)

8. Mechanical/Environmental Characteristics

Refer to UN38.3

9. Safety

9.1 External short circuit

(1) Test method: charge the unit cell to SOC 100% with standard current. After stabilizing the unit cell at room temperature for 1 hour, connect the '+' and the '-' terminals to each other in the external resistance. The total external resistance including wires should be 30 ±10mΩ or less by agreement between the manufacturer and the user. Proceed in a shorted state for 6 hours or until the surface temperature of the unit cell drops below 20% of the maximum rising temperature.

(2) Measure and record the following: The frequency of recording voltage and current is less than 1 second.

a. Record: voltage, current, surface temperature, total external resistance value

b. Criteria: no fire, no explosion

9.2 Impact

(1) Test method: charge the unit cell to SOC 50% with standard current. Place the unit cell on a flat surface and place a 15.8 mm diameter round bar across the center of the unit cell. However, the length of the round bar shall be longer than the length of the unit cell of the part to be evaluated. A 9.1 ±0.46kg weight is to be dropped from a height of 610 ±25mm onto the sample. Observe the unit cell at room temperature for six hours after the end of the test.

(2) Measure and record the following: The frequency of recording voltage is less than 1 second.

a. Record: voltage, surface temperature

b. Criteria: no fire, no explosion

9.3 Heating

(1) Test method: charge the unit cell to SOC 100% with standard current. Stabilize the unit cell at room temperature for 1 hour or until it is in a thermal stable state. The ambient temperature is raised to 130±2°C at a temperature increase rate of 5 ±2°C/min, and the cell is held at this temperature for 10 minutes.

(2) Measure and record the following: The frequency of recording voltage is less than 1 second.

a. Record: voltage, surface temperature

b. Criteria: no fire, no explosion.

9.4 Overcharge

(1) Test method: Discharge the unit cell to SOC 0% with standard current. Stabilize the unit cell at room temperature for 1 hour or until it is in a thermal stable state. Charge the unit cell with the maximum charging current specified by the manufacturer. Stop the test when the voltage of the unit cell reaches 120% of the upper charging voltage specified by the manufacturer. However, if 120% of the upper charging voltage is not reached due to the operation of the protective function, the test shall be stopped if no more charging current is applied. Observe the surface temperature of the unit cell until it reaches room temperature ±10°C

(2) Measure and record the following: The frequency of recording voltage and current is less than 1 second.

a. Record: voltage, current, surface temperature

b. Criteria: no fire, no explosion

9.4 Overdischarge

(1) Test method: Discharge the unit cell to SOC 0% with standard current. Stabilize the unit cell at room temperature for 1 hour or until it is in a thermal stable state. The discharged unit cell is charged by reversing the positive and negative terminals at a current of 0.5C for 180 minutes. However, if the maximum discharging current is less than 0.5C, the battery shall be charged for the time required to reach 150% of the rated capacity at that current.

(2) Measure and record the following: The frequency of recording voltage and current is less than 1 second.

a. Record: voltage, current, surface temperature

b. Criteria: no fire, no explosion

10. Shipment

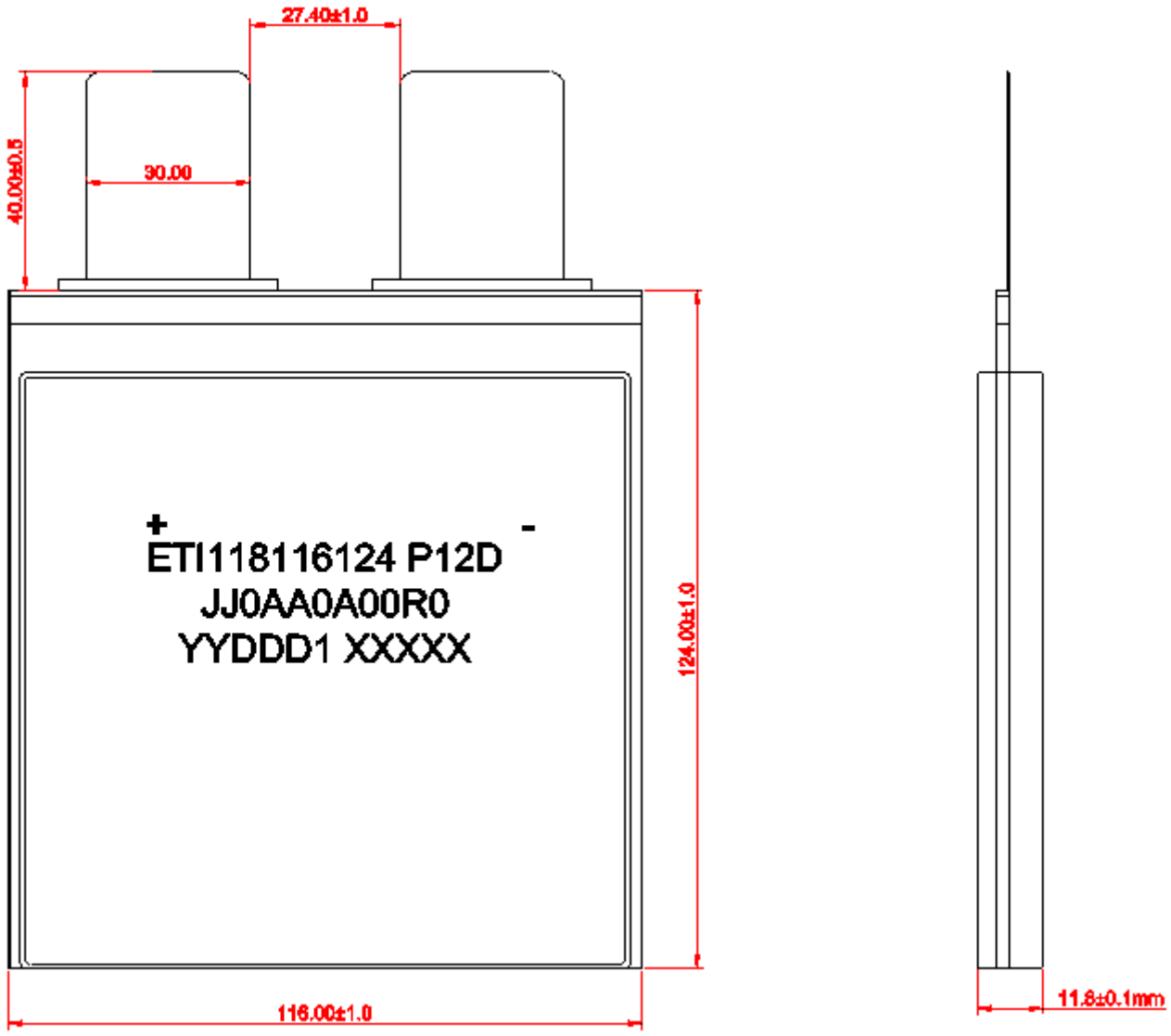
The cell shall be shipped in partially charged state.

11. Warranty

ENERTECH INTERNATIONAL INC. will be responsible for replacing the cell against defects or poor workmanship for 6months from the date of shipping. Any other problem caused by malfunction of the equipment or unsuitable use of the cell is not under this warranty. The warranty set forth in proper using and handling conditions described above and excludes in the case of a defect which is not related to manufacturing of the cell.

[Appendix A] Out view drawing for ETI58253172 F20B

(unit : mm)



Explanation

1) 17Digit (Model name) : ETI58253172 F20B
2) 11Digit (Supplier number) : JJ0AA0A00R0
3) 12Digit : 6Digit (Julian date + Manufacture line), 1blank, 5Digit (Serial No.) : 00001 ~ 99999

[Appendix B] Proper Use and Handing of Lithium Ion Rechargeable Cell

1. General

The cells supplied by **ENERTECH INTERNATIONAL INC**. have to be handle carefully according to the specification. Here are some more to be followed.

2. Storage

The cells should be requested to be stored under the following conditions.

a. Indoor storage in a cool circumstance without direct sun light.
b. Store the cell in a dry location with low humidity and recommended temperature range is 25 ±3°C.
c. As long-term storage can accelerate battery self-discharge and lead to the deactivation of the cell.

To minimize the deactivation effect, store the cell in a temperature range of 25 ±3°C.

d. When charging for the first time after long-term storage, the deactivation of the cell has led to the decreased capacity.
e. The cell should be used within a short period after charging because long-term storage may cause the loss of capacity by self-discharging.
f. Over-discharging may occur by self-discharge if the cells are left for a long time without any use.
g. If long-term storage is necessary, the cells should be stored at lower voltage within a range specified in the product specification, because storage at higher voltage may cause loss of characteristics.

3. Charging and Discharging

a. Charging and discharge current should be used less than maximum current specified within the product specification.
b. Charging and discharge voltage should be used in the range of operating voltage specified within the product specification.
c. The cells should be charged and discharged within a range of specified temperatures in the cell specification.
d. Use suitable charger with the specified voltage and current. We strongly recommend the smart battery charger. We can recommend the usage or specification of the charger manufacturing. If you want to get the information about it, please contact us.
e. Never attempt reverse charging. Charging with polarity reversed can cause a reversal in the cell polarity, causing gas pressure inside of the cell to rise, which can be led to leakage of the cell.
f. Avoid overcharging. Repeated overcharging can be led to deterioration in cell performances and over-heating occurred.
g. Charging efficiency drops at temperatures above 40°C.

4. The end of life for the cells

a. The cells can be charged and discharged repeatedly up to times specified in the produce specification with a certain level of capacity also specified in the product specification.
b. The end of life for the cells may be determined by conditions of charging, discharging, operating temperature and/or storage.

5. Protection from unexpected damaged to the cell

a. (+) and/or (-) terminals must not be connected in metal wire, necklace, chains.
b. Do not drop cells from height in order to prevent them from possible malfunction or damage.
c. Do not twist or bend cells in order to prevent possible damage.

6. For safety

a. Do not dissemble cells
b. Do not use the cell when something abnormal found such as smells, deformation, discoloration, and so on.
c. When the electrolyte leakage occurs, do not touch the liquid. When the electrolyte is coming in contact with the skin or eye, Flush immediately with fresh water and seek medical advice.
d. Soaking the cells in water is strictly prohibited, because it may cause melt of components to the damaged functions. Once watered, do not use those cells.
e. Do not have cells in the hot-temperature (60°C or more).
f. The usage by children should be supervised
g. Don't put the battery into a microwave oven, dryer, or high-pressure container.
h. Do not fold, crush and nail the cells.

i. Replace battery packs when using time of battery becomes much shorter than usual.
j. The cell should not be dismantled from the battery pack. Internal short-circuit caused by disassembly may lead to heat generation and/or venting.
k. Short-circuit results in very high current which leads to heat generation. So, an appropriate circuitry should be employed to protect accidental short-circuiting.
l. Mixing use of different types of cells, or same types but different manufacture's cell may lead to cell rupture or damage to battery pack due to the different characteristics of cell. And don't use or assemble old and new cells together.
m. Incinerating and disposing of the cell in fire are strictly prohibited, because it may cause rupture.
n. The cells and battery packs should be disposed with a discharged state to avoid heat generation by an inadvertent short-circuit. And cover terminals with proper insulating tape before disposal.
o. The cells and battery packs should be disposed according to the local environmental regulations when they are disposed.

[Appendix C] Pack assembly requirement

1. General

This document is to specify the standards and cautions to handle the large format cell manufactured by Enertech International, Inc. Please refer to the "cell specification" as to how to generally handle and use the cell. But please be aware and comply with this document when you assemble the battery pack using ETI's large format cell.

[Terminology]

A battery pack means the product composed of one or more large format cells, which are connected in series or parallel, and BMS (Battery Management System) including protection module.

2. Please comply with the "cell specification" of each large format cell for the general usage of the cells.

a. The cell should be inspected visually before battery pack assembly.
b. Do not use the cell damaged while the cell is being handled.
(Pouch-torn, strong dent, scratch on the surface, electrolyte-smell and etc.)
c. Please refer to the "Cell Specification" for the safety handling.

3. BMS should have the following functions at least.

Include protection function against over-charge, over-discharge, over-current, voltage-imbalance,
Over-temperature and so on.
a. Over-charge protection: Cell maximum voltage.
b. Over-discharge protection: Cell minimu votlage.
c. The voltage difference of the cells should be within 100mV during pack-operation. If the difference is over 100mV, charging and discharging should not work.
d. If C-rate for continuous charging and discharging is over 1C, it should have the cooling system. If the temperature of the cells is beyond the temperature specified in the specification, charging and discharging should not work.
e. The charger should be communicated with the battery pack. Charging and discharging should be worked or not, based on the received battery's signals.

4. Refer to the following charging and discharging conditions of the cell

a. Charging mode: CC-CV mode
b. Charging Voltage: Cell maximum voltage
c. Max charging current: refer to the cell specification.
d. Fully charged condition: should be controlled with taper current (1/20C) and timer detection.
e. Cut-off voltage of discharging: must be over cell minimum voltage.
f. Maximum discharging current: at less than specified in the cell specification

5. Cautions for battery pack assembly

a. All cells should have the same range of voltages, the difference of which should be within 20mV and all cells should be in the same Enertech production lot.
b. Secure minimum 0.3mm between cells if more than 2 cells should be stacked for the pack assembly (for swelling).

c. Remove the dust or foreign substance between cells if more than 2 cells should be stacked for the pack assembly.
d. Do not place the sharp or heat sources and high temperature components close to the cell when battery pack is designed. Otherwise, it may cause loss of characteristics.
e. The cell should not be soldered directly with leads. Otherwise, it may cause damage of component, such as separator and insulator, by heat generation.
f. The pack should equip with appropriate shock absorbers in order to minimize mechanical shock. Otherwise, it may cause shape distortion, leakage, heat generation or rupture.
g. The battery pack should be designed to be connected only to the specified charger and system.
h. A reverse connection of the cells, even in the specified battery pack, should be avoided by employing special battery design, such as special terminals. Reverse charging should be strictly prohibited.
i. Do not fold or cut the sealing or corner of the cell.
j. Check the polarity printed on the cell before battery pack assembly.
k. The cell should not be dismantled from the battery pack, Internal short-circuit caused by disassembly may lead to heat generation.