Test Report 40Ah LTO Grade B cells

1. Tested cell reference

Order Number: 97852474001020189, Order Date: 2021-07-07 08:36:41, quantity 32, USD 1,193.60
Order Number: 98272571501020189, Order Date: 2021-07-07 08:34:09, quantity 100, USD 3,730.00
Arrival date: 2021-10-02 16:26:42

2. Inspection and quick test

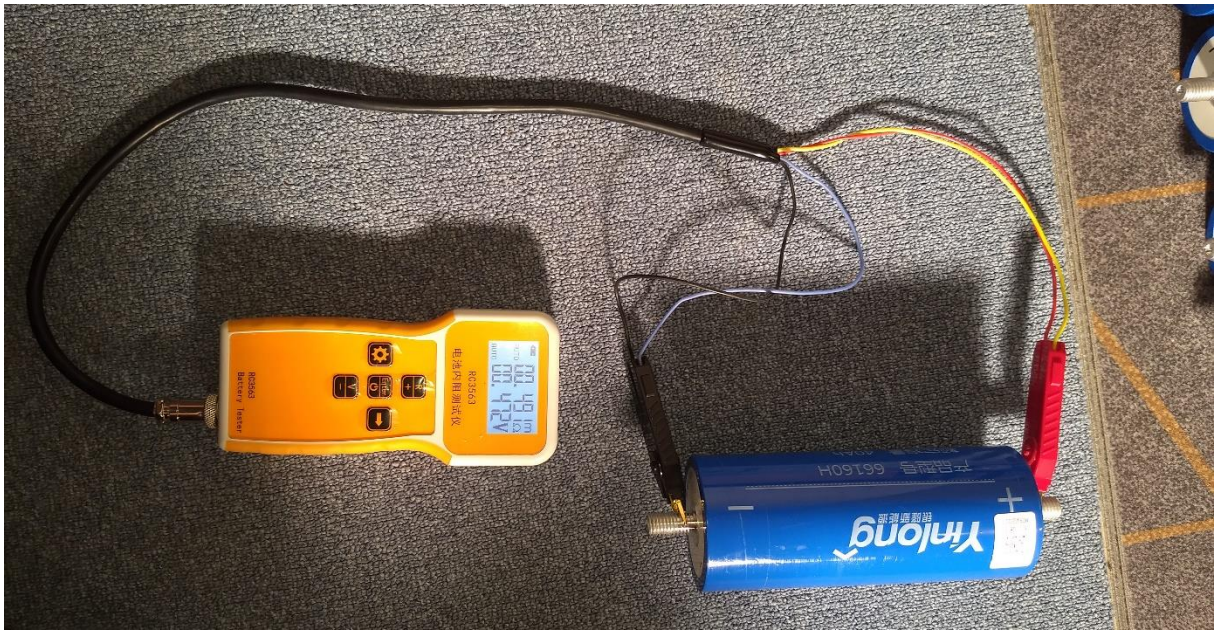

Figure 1: Inspection and categorizing of each cell

3. Test setup

Capacity testing of random cells and suspicious cells (impedance > 1mΩ) with test device:
ZKE EBC-A40L

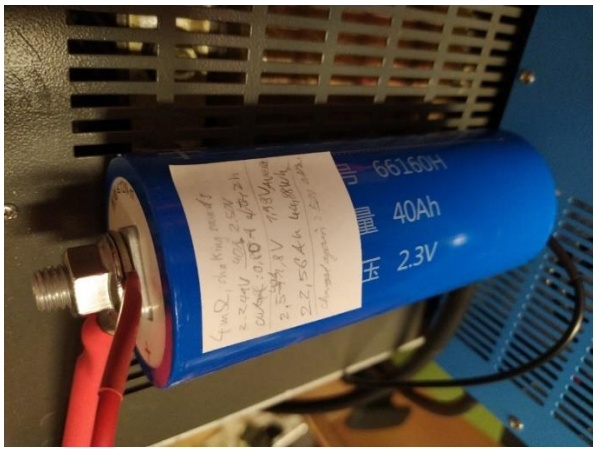

Figure 2: Test setup with tubular cable lugs and 16mm² wire cross-section, torqued down with 7Nm, separate voltage sense wires

Test setup: Charge to 2.90V with 1C (40A), 10min waiting time, discharge with 1C to 1.50V (see datasheet specification in Appendix).

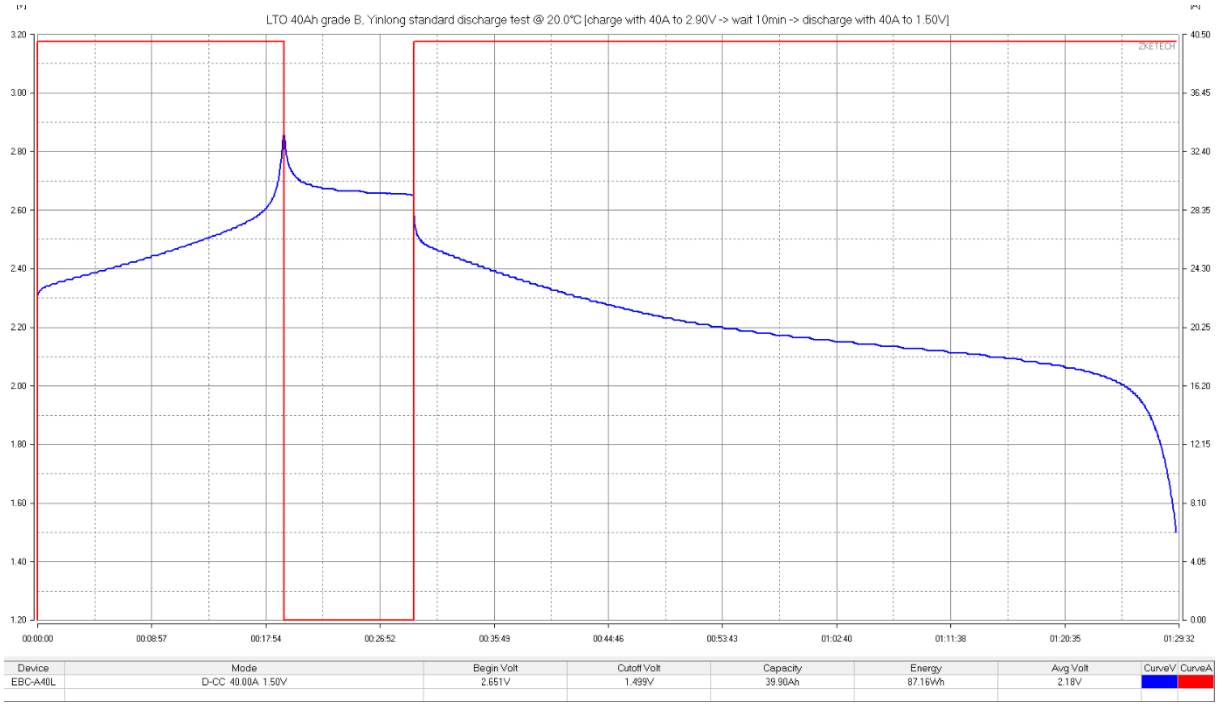

*Figure 3: Capacity test result of random cell with standard test condition [**87.16Wh**] (13.10.2021)*

The tested cell achieved **87.16Wh**. The **typical energy of 97.00Wh** could not be reached.
There is still 10% less energy available, then stated in the datasheet for a brand-new cell.

4. Impedance / high internal resistance cell tests

Several high internal resistance cells have been tested. All of them underperformed and show degradation and internal malfunctions (Figures 5, 6 and 7).

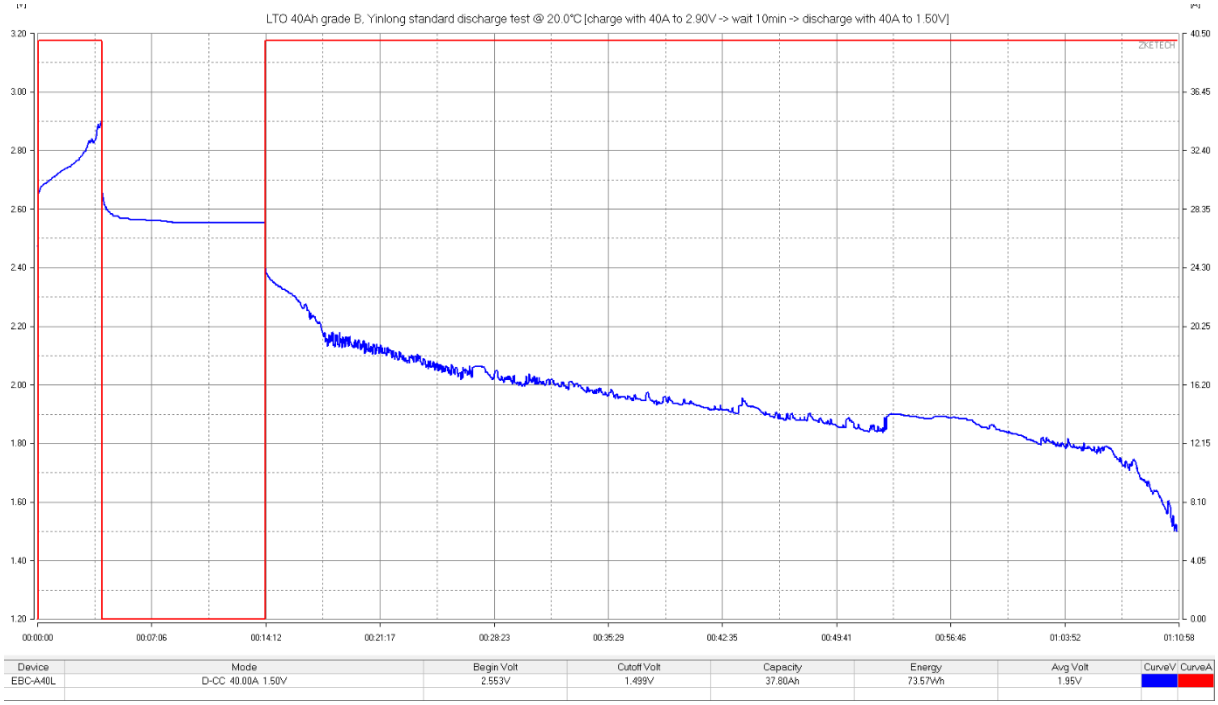

*Figure 4: **4mΩ** internal resistance [**73.57Wh**] (13.10.2021)*

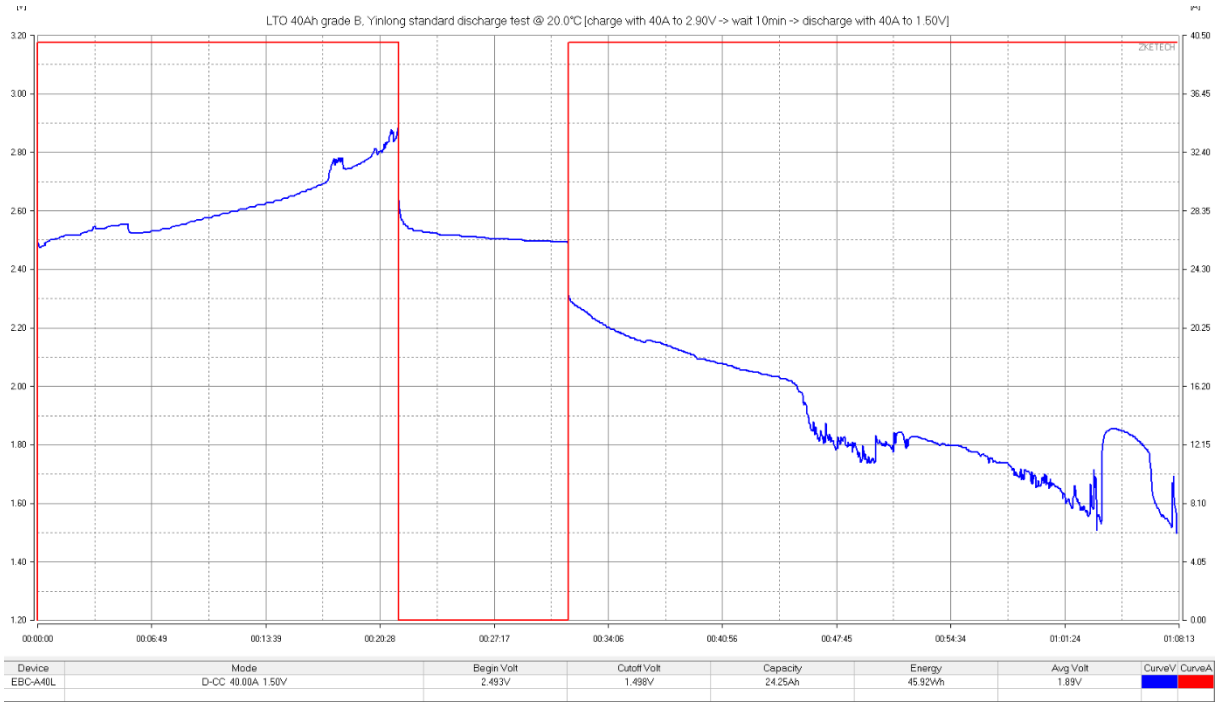

*Figure 5: **8mΩ** internal resistance [45.92Wh] (13.10.2021)*

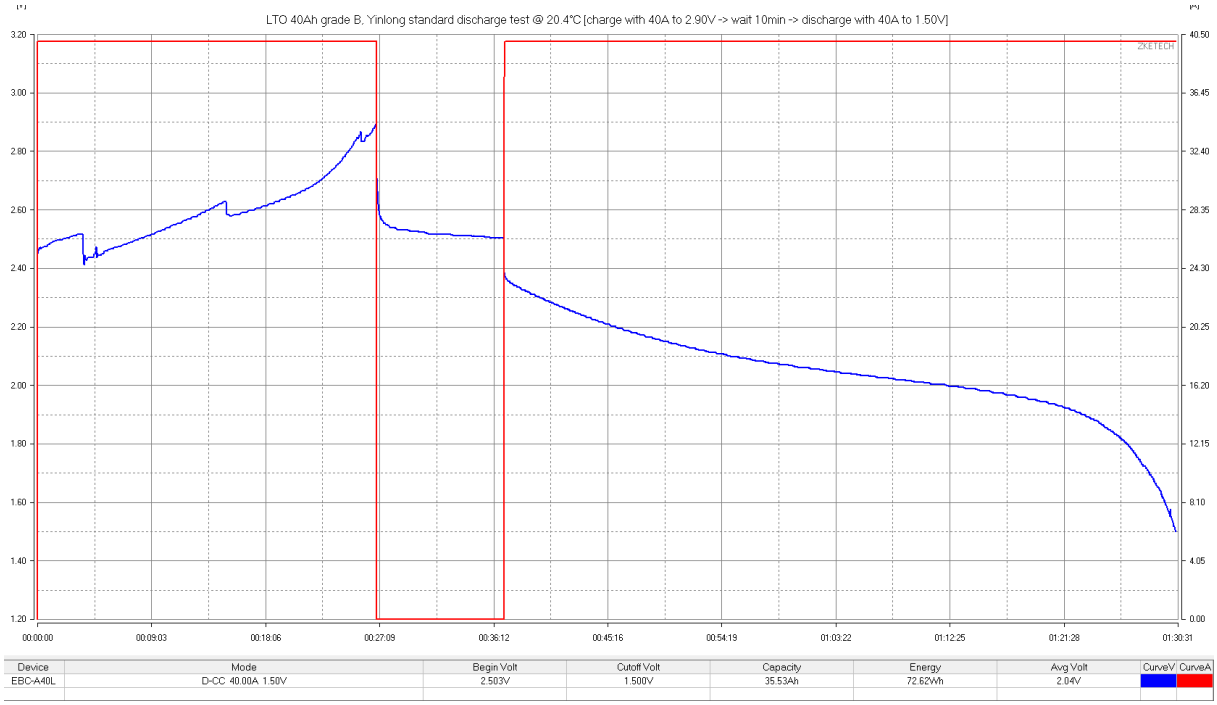

*Figure 6: **3.86mΩ** internal resistance [72,62Wh] (13.10.2021)*

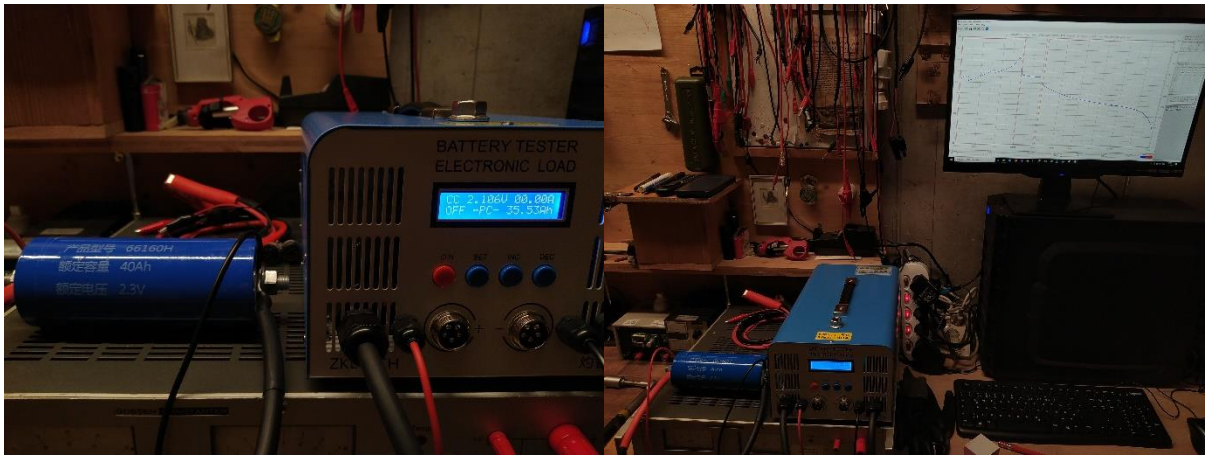

*Figure 7: **3.86mΩ** internal resistance test setup*

Conclusion:

All the tested cells with high internal resistance, performed way worst then the normal grade B cell (Figure 4). They can't be used in the same array, because they would significantly reduce the capacity of the whole pack. Also, their average discharge voltage is too low [1.95V (Figure5), 1.89V (Figure 6) and 2.04V (Figure 7)]. The normal grade B cell has a average voltage of 2.18V (Figure 4).
Those cells cannot be used in a normal installation anymore.

5. Comparison between grade A cell 2019 and grade B cell 2016

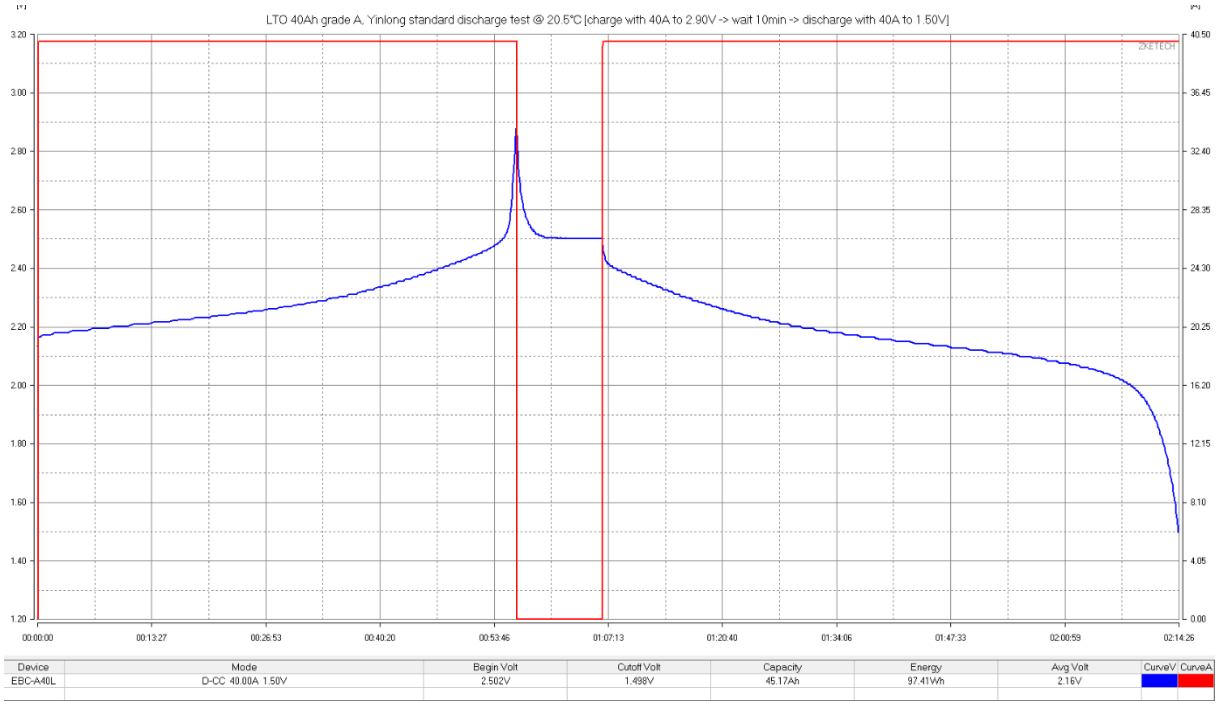

Figure 8: Grade A cell 2019 [97.41Wh] (12.10.2021)

In Figure 9, you can see, how a grade A cell from 2019 performs over the grade B 2016 cells from Shenzhen Yidong Technology Co., Ltd.

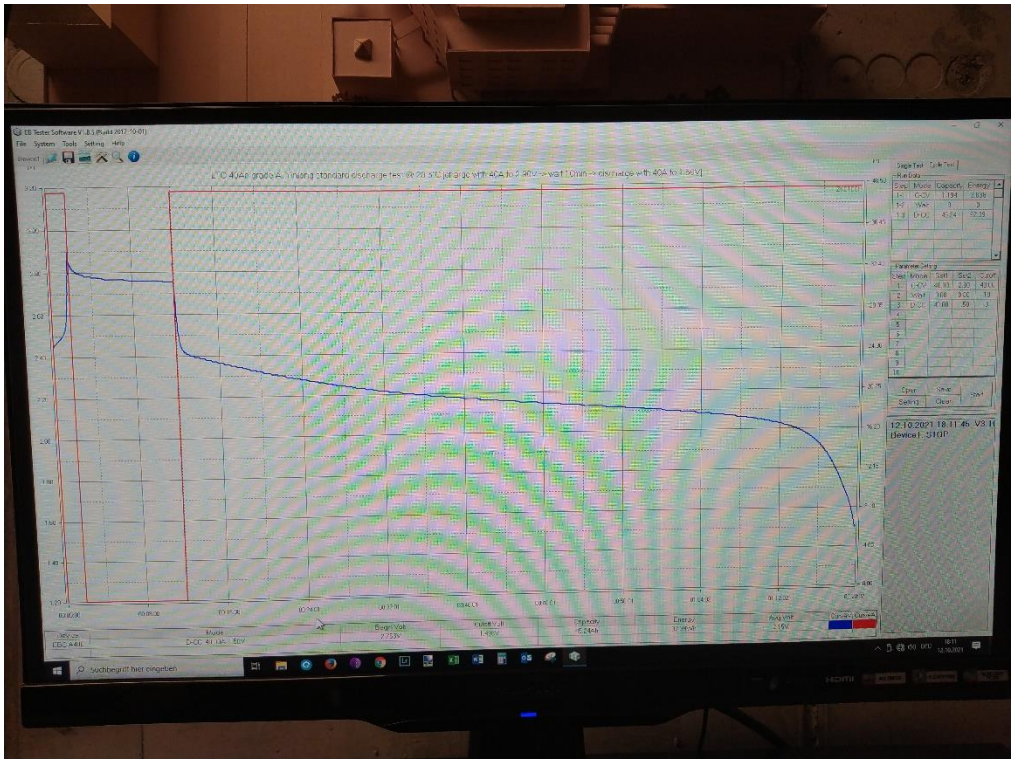

Figure 9: Grade A cell 2019 with 0.282mΩ internal resistance

The Grade A cell has been tested with exactly the same test setup and was able to store more energy [97.41Wh] than the advertised 97.00Wh (Figure 9 and 10).

Raphael Hofmann

Autarke Energieversorgung
Am Schlachtbichel 3
87660 Irsee
Germany

Phone (landline): +4983419618680
E-Mail: autarke-energieversorgung@poseo.de

6. Appendix

Datasheet

SPECIFICATIONS of YLE-LTO-66160 BATTERY

Yinlong 银隆新能源

40 Amp Hour Cell

NANO LITHIUM TITANATE BATTERY CELL

Performance Characteristics	Nominal Values
Nominal Voltage	2.3 V
Capacity (Minimum / Typical @40 amp [1C rate] at 25°C, CCCV charge)	40 / 42 Ah
Typical high rate capacity (240 amp at 25°C, CCCV charge)	37 Ah
Typical energy (40 amp [1C rate] at 25°C, CCCV discharge)	97 Wh
Pulse power (400 amp [10C rate], 10s pulse, 50% SOC at 25°C) (discharge, charge)	TBD
Pulse power (FreedomCAR, 10s pulse, 50% SOC at 25°C) (discharge / charge)[1]	1550 W, 3755 W
Energy density	177 Wh/L
Power density (discharge, charge)[1]	2834 W/L, 6865 W/L
Specific energy	79 Wh/kg
Specific power (discharge, charge)[1]	1260 W/kg, 3053 W/kg
Internal charge impedance (10 sec DC pulse, 50% SOC, 25°C)	0.7mΩ
Internal discharge impedance (10 sec DC pulse, 50% SOC, 25°C)	0.7mΩ
Max continuous charge	400 A
Max continous discharge	400 A
Max 10 sec Pulse discharge or charge current	800 A
Internal Impedance (1 Hz AC, 10% SOC, 25°C)	0.29 mΩ

Life Characteristics	
Cycle life at 2C charge and 2C discharge, 100% DOD, 25°C	>25,000 to 80% initial capacity
Cycle life at 2C charge and 2C discharge, 100% DOD, 55°C	>3000 to 90% initial capacity
Calendar life at 25°C	25 years

Temperature Limits[2]	
Operating and Storage temperature range	-50°C to + 65°C cell temperature

Voltage Limits[3]	
Discharge cut off voltage at -40°C to + 55°C	1.5 V
Charge cut off voltage at -40°C to + 55°C	2.9 V

Cell Dimensions[4]	
Diameter (Φ) x Height (H)	66 mm (Φ) x 160 mm (H)
Weight	1.22 kg

Transportation	
Transportation Specifications	Tested to UN 38.3

1. Power at 25°C for 10 sec is calculated using FredomCar discharge formulas.
2.Optimal storage temperature is 25°C.
3. In battery systems, the battery management system must enforce the voltage limits at the individual cell level.
4. Cell terminal heights are not included in the stated cell dimensions.

Updated date 18/01/2018

银隆新能源电池应用及工艺研究院

文件名称：YLE-LTO-66160 圆柱电池规格书

SPECIFICATIONS of YLE-LTO-66160 BATTERY

电池型号: YLE-LTO-66160/40Ah

Document No. 文件编号	Version 版次	Department 拟案单位	Valid Date 生效日期
YTE-SPEC-LTO66160-04	A/2	电池应用及工艺研究院	2019-06-20
Design 编制	Check 审核		Approval 批准

Customer Approval 客户	Signature/Date 签字/日期	
	Company Name 公司名称	
	Company Stamp 公司印章	

Revision History 文件修订履历

Version 版次	Revision Status 修订内容	Editor 编制人	Pages 修订页次	Date 修订日期
A1	The second edition 升版发行	张要枫	全部页次	2018.04.08
A2	The second edition 升版发行	陈旻	全部页次	2019.06.20

目　录

1. 适用范围 Scope

本规格书描述纳米钛酸锂电池之基本参数、电化学特性、可靠性及其试验和判定标准、使用说明、安全规程、质量评定及包装、贮存和运输等，适用于河北银隆新能源有限公司制造的 LTO66160/40Ah 纳米钛酸锂电池。

This specification describes the titanate lithium cell's basic parameters, electrochemical characteristics, reliability and its test method, decision criteria, instructions, safety procedures, quality evaluation, packaging, storage, and transportation, and etc. The specification is applied to the LTO66160/40Ah lithium ion cell manufactured by Hebei Yinlong Energy Co., Ltd.

2. 概述 Description

产品型号：YLE- LTO66160/40Ah 纳米钛酸锂动力电池。

Product model: YLE- LTO66160/40Ah Lithium Titanate Power Cell

2.1 电池构成 Cell Component

本电池为纳米钛酸锂电池，由正极、负极（钛酸锂）、隔膜、电解液和铝制金属外壳等组成。

This cell is of cylindrical lithium titanate cell which is composed of negative and positive electrode, separator, electrolyte and metal case etc.

2.2 引用标准 Adopted Standard

GB/T 31486-2015 电动汽车用动力蓄电池电性能要求及试验方法

GB/T 31486-2015 Electrical performance requirements and test methods for traction cell of electric vehicle

GB/T 31485-2015 电动汽车用动力蓄电池安全要求及试验方法

GB/T 31485-2015 Safety requirements and test methods for traction cell of electric vehicle

GB/T 31484-2015 电动汽车用动力蓄电池循环寿命要求及试验方法

GB/T 31484-2015 Cycle life requirements and test methods for traction cell of electric vehicle

3. 电池性能测试条件 Test Conditions of Cell Properties

3.1 标准测试条件 Standard Test Conditions

3.1.1 标准测试环境 Standard Test Environment

测试样品要求：出厂时间≤ 7 天，充放电次数≤ 5 次。

Test should be conducted with new cells within one week after shipment from our factory and which is not cycled more than five times before the test.

除非有其他特殊说明，本规格书中所有测试都在以下环境条件进行：

Unless otherwise specified, all tests stated in this Product Specification are conducted at below condition:

温度：25 ± 5 °C；Temperature：25 ± 5 °C；

相对湿度：15%~90%；Humidity：15%~90%；

大气压力：86kPa~106kPa；Atmospheric pressure：86kPa~106kPa.

海拔：≤4000m。Height above sea level：≤4000m.

本规格书所提到的室温是指 25℃±5℃。

The room temperature mentioned in this product specification is 25℃±5℃.

3.1.2 标准充电方式 Standard Charge Method

在标准环境条件下，以 1I_1(40A)电流恒流充电至充电截止电压，停止充电。

Under standard test environment, a cell is charged to the standard charge cut-off voltage at a constant current of 1 I_1(40A), then stopped charging.

3.1.3 标准放电方式 Standard Discharge Method

在标准环境条件下，以 1 I_1(40A)电流恒流放电至放电截止电压，停止放电。

Under standard test environment, a cell is discharged to the standard discharge cut-off voltage at a constant current of 1 I_1(40A), then stopped discharging.

3.1.4 初始容量 Initial Capacity

新出厂的电池，在室温下，完全充电后，以1I_1 (40A)电流恒流放电至放电截至电压时所放出的容量（Ah）。

Under standard test environment, a fresh cell is charged in accordance with 3.1.2, and then discharged to the standard discharge cut-off voltage at a constant current of 1I_1 (40A), the discharge capacity is defined to be initial capacity.

3.2 测量器具及设备 Measuring Instruments or Apparatus

3.2.1 尺寸测量设备 Dimension Measuring Instrument

测量尺寸的仪器精度应不小于 0.01mm。

Dimension measurement shall be implemented by instruments which accuracy should not be less than 0.01mm.

3.2.2 电压表 Voltmeter

国家标准或更灵敏等级，内阻不小于 10 kΩ/V。

Standard class specified in the national standard or more sensitive class having inner impedance not less than 10kΩ/V.

3.2.3 电流表 Ammeter

国家标准或更灵敏等级，外部总体内阻包括电流表和导线应小于 0.01Ω。

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 内阻测试仪 Impedance Meter

内阻测试仪测试方法为交流阻抗法(AC 1kHz LCR)。

Impedance shall be measured by a sinusoidal alternating current method (AC 1kHz LCR meter).

4. 技术规格 Specification

4.1 单体电池基本参数 Cell Specification

序号 No.	项目 Item	参数 Parameters	备注 Remark
1	外观 Appearance	符合外观检验标准 Accord with appearance inspection standard	电池外观应无划伤、破裂、污渍、生锈漏液等影响市场价值的缺陷。 There should be no such defects as flaw, crack, rust, leakage, which may depreciate the commercial value of cell.
2	额定容量 Rated Capacity	40Ah	
3	标称电压 Nominal Voltage	2.3V	
4	内阻 Internal Impedance	≤1.0mΩ	50%荷电状态下用交流法测量内阻 Internal resistance measured at AC 1kHz after 50% charged.
5	标准充电截止电压 Standard Charge Cut-off Voltage	2.9V	
6	标准放电截止电压 Standard Discharge Cut-off Voltage	1.5V	
7	最大持续充电电流 Maximum Continuous Charge Current	$6I_1$（240A）	25℃±5℃
8	最大持续放电电流 Maximum Continuous Disharge Current	$6I_1$（240A）	25℃±5℃

9	最大脉冲充/放电电流（10s）Maximum Pulse Charge/Discharge Current(10s)	$10I_1$（400A）	25℃±5℃
10	工作温度范围 Operating Temperature Range	温度：-40~65℃ 相对湿度：≤85% Temperature:-40~65℃ Humidity： ≤85%RH	当电池温度低于 0℃时，建议充/放电电流≤1 I_1(40A)，当温度高于 35℃，建议对电池进行降温。 Recommended charge/discharge current ≤1 I_1(40A), when cell temperature is lower than 0℃， Recommended cool the cell, when cell temperature is higher than 35℃.
11	储存温度范围 Storage Temperature Range	-5℃~28℃	推荐 Recommend（25±3℃）；≤90%RH 储存湿度范围。 ≤90%RH storage moisture range.
12	尺寸 Dimension	直径：66.0±1.0mm 高度：161.0±1.0mm Diameter: 66.0±1.0mm Height: 161.0±1.0mm	电池详细尺寸，请参看本规格书“11.电池结构示意图”。 The detailed dimension can be found in "11.Scheme of the cell structure" of this specification.
13	重量 Weight	1230.0±10g	

4.2 单体电池电化学性能参数 Cell Electrochemical Performance

序号 No.	项目 Item	测试方法 Test Method	标准 Criteria
1	循环寿命 Cycle Life	在标准测试环境下，电池按 3.1.2 规定充电，搁置 10 分钟，而后按 3.1.3 规定放电，搁置 10 分钟，再进行下一个充放电循环，连续进行充放电循环 16000 次。 Under standard test environment, a cell is charged in accordance with 3.1.2, rest 10 minutes, and then discharged in accordance with 3.1.3, rest 10 minutes prior to next charge-discharge cycle. The cell shall be continuously charged and discharged for 16000 cycles.	16000 次循环后，放电容量≥80%*初始容量 Discharge Capacit≥80%*initial capacity after16000 cycles

2	高温循环寿命 High Temperature Cycle Life	将电池放入 55±2℃恒温环境中搁置 30 分钟，在 55±2℃恒温环境中按照 3.1.2 进行充电至充电截止电压，搁置 10min 后再按照 3.1.3 进行放电至放电截止电压，重复循环充放电 1000 次。 A cell is stored in an ambient temperature of 55±2℃ for 30min. Then at 55±2℃, a cell is charged to the standard charge cut-off voltage at 3.1.2, rest 10 minutes, and then discharged to the standard discharge cut-off voltage at 3.1.3, rest 10 minutes prior to next charge-discharge cycle. The cell shall be continuously charged and discharged for 1000 cycles.	1000 次循环后，放电容量≥96%*初始容量 Discharge Capacit≥96% *initial capacity after 1000 cycles
3	倍率充电性能 Rate Charge Performance	在标准测试环境下，电池按 3.1.3 规定放电，搁置 10 分钟，而后以 6I_1(240A)电流充电至标准充电截止电压，计算充电容量（Ah）与初始容量的比值(%)。 Under standard test environment, a cell is discharged in accordance with 3.1.3, rest 10 minutes, and then charged to standard cut-off voltage at a constant current of 6I_1 (240A).Calculate the ratio of charge capacity (%).	6I_1(240A)充电容 量≥90%*初始容量 Charge capacity≥90% initial capacity with 6I_1(240A)
4	倍率放电性能 Rate Discharge Performance	在标准测试环境下，电池按 3.1.2 规定充电，搁置 10 分钟，而后以 6I_1(240A)电流放电至标准放电截止电压，计算放电容量（Ah）与初始容量的比值(%)。 Under standard test environment, a cell is charged in accordance with 3.1.2, rest 10 minutes, and then discharged to standard cut-off voltage at a constant current of 6I_1(240A).Calculate the ratio of discharge capacity (%).	6I_1(240A)放 电 容 量≥90%*初始容量 Discharge capacity≥90%*initial capacity with 6I_1(240A)
5	高温(65℃)放电容量 Discharge Capacity at 65℃	电池按 3.1.2 规定充电结束后，将电池放入 65±2℃恒温环境中搁置 5±0.5h，然后按 3.1.3 规定放电，计算放电容量（Ah）与初始容量的比值(%)。A cell is charged in accordance with 3.1.2, and stored in an ambient temperature of 65±2℃ for 5±0.5h, and then discharged in accordance with 3.1.3，Calculate the ratio of discharge capacity (%).	65℃放电容量≥100%*初始容量 Discharge capacity≥100%*initial capacity at 65℃
6	低温充电性能 Low Temperature Charge Performance	电池按 3.1.3 规定放电结束后，将电池放-20±2℃/-40±2℃恒温环境中搁置 24±0.2h，然后以 1I_3(13.3A)电流充电至标准充电截止电压，计算充电容量（Ah）与初始容量的比值(%)。 A cell is discharged in accordance with 3.1.3, and stored	-20℃充电容量≥92%*初始容量 Charge capacity ≥ 92%* initial capacity at-20℃

		in an ambient temperature of-20 ±2℃/-40 ±2℃ for 24±0.2h, and then charged to standard charge cut-off voltage at a constant current of 1I_3(13.3A).Calculate the ratio of charge capacity (%).	-40 ℃充电容量 ≥68%*初始容量 Charge capacity ≥ 68%* initial capacity at -40℃
7	低温放电性能 Low Temperature Discharge Performance	电池按 3.1.2 规定充电结束后，将电池放-20±2℃/-40 ±2℃恒温环境中搁置 24±0.2h，然后以 1I_3(13.3A)电流放电至放电截止电压，计算放电容量（Ah）与初始容量的比值(%)。 A cell is charged in accordance with 3.1.2, and stored in an ambient temperature of-20 ±2 ℃ /-40 ±2 ℃ for 24±0.2h, and then discharged to standard discharge cut-off voltage at a constant current of 1I_3(13.3A). Calculate the ratio of discharge capacity (%).	-20 ℃放电容量 ≥70%*初始容量 Discharge capacity ≥ 70% * initial capacity at -20℃ -40℃放电容量≥ 53%*初始容量 Discharge capacity ≥ 53% * initial capacity at -40℃
8	常温荷电保持与容量恢复能力 Retention Capability and Capacity recovery at Room Temperature	电池按 3.1.2 规定充电结束后，将电池在室温环境中搁置 28 天，然后按 3.1.3 规定放电，计算放电容量（Ah）与初始容量的比值(%)。再按 3.1.2 规定充电，搁置 10 分钟，按 3.1.3 规定放电，计算放电容量（Ah）与初始容量的比值(%)。 A cell is charged in accordance with 3.1.2, stored in an ambient temperature of 25 ±5℃for 28 days, then discharged in accordance with 3.1.3.Calculate the ratio of discharge capacity (%).Charged in accordance with3.1.2，rest 10 minutes，discharged in accordance with3.1.2. Calculate the ratio of discharge capacity (%).	常温剩余容量≥85%*初始容量，恢复容量≥95%*初始容量 The residual capacity is not less than 85% of the initial capacity, and the recoverable capacity is not less than 95% of the initial capacity at room temperature
9	55℃荷电保持与容量恢复能力 Retention Capability and Capacity Recovery at 55℃	电池按 3.1.2 规定充电结束后，将电池在 55±2℃环境下储存 7 天，然后按 3.1.3 放电，计算放电容量（Ah）与初始容量的比值(%)。再按照 3.1.2 规定充电，搁置 10 分钟，按 3.1.3 放电，计算放电容量（Ah）与初始容量的比值(%)。 A cell is charged in accordance with 3.1.2, and stored in an ambient temperature of 55 ±2℃for 7 days, then discharged to standard discharge cut-off voltage at a constant current of 1 I_1(40A).Calculate the ratio of discharge capacity (%).charged in accordance with 3.1.2，rest 10 minutes，a discharged in accordance with 3.1.2. Calculate the ratio of discharge capacity (%).	55℃剩余容量≥85%*初始容量，恢复容量≥95%*初始容量 The residual capacity is not less than 90% of the initial capacity, and the recoverable capacity is not less than 95% of the initial capacity at 55℃

5. 单体电池可靠性测试 Cell Reliability Test

序号 No.	项目 Items	测试方法及条件 Test Method and Conditions	标准 Criteria
1	过放电 Over Discharge	电池按 3.1.2 规定充电结束后，对电池以 1 I_1(40A)电流放电 90min，观察 1h。 A cell is charged in accordance with 3.1.2, then discharged at a constant current of 1 I_1(40A) for 90 minutes, observed for 1h	不爆炸、不起火、不漏液 No explosion, No fire, No leakage
2	过充电 Over Charge	电池按 3.1.2 规定充电结束后，对电池以 1 I_1(40A)恒流充电，至电压达到 4.35V 或充电时间达到 1h，观察 1h。 A cell is charged in accordance with 3.1.2, then charged to 4.35V or charge time is over 1h at a constant current of 1I_1(40A), observed for 1h.	不爆炸、不起火 No explosion, No fire
3	短路 Short Circuit	电池按 3.1.2 规定充电结束后，将电池正、负极经外部短路 10min，外部线路电阻应小于 5mΩ，观察 1h。 A cell is charged in accordance with 3.1.2, then short-circuited by connecting the positive and negative terminals for 10 min with a external line having a maximum resistance of 5mΩ, then observed for 1h.	不爆炸、不起火 No explosion, No fire
4	跌落 Dropping	电池按 3.1.2 规定充电结束后，从 1.5 米高度自由跌落至水泥地面上，观察 1h。 A cell is charged in accordance with 3.1.2, then dropped from a height of 1.5 meters onto the concrete-based ground, observed for 1h.	不爆炸、不起火、不漏液 No explosion, No fire, No leakage
5	加热 Heating	电池按 3.1.2 规定充电结束后，在温度箱中按照 5℃/min 的速率由室温升至 130±2℃，并保持 30min 后停止加热，观察 1h。 A cell is charged in accordance with 3.1.2, stored in a temperature box for 30min at the temperature of 130±2℃ with a heating rate of 5℃/min stopped heating , then observed for 1h.	不爆炸、不起火 No explosion, No fire

6	挤压 Crush	电池按 3.1.2 规定充电结束后，挤压板（半径 75mm、长度大于被挤压电池的尺寸的半圆柱体）以（5±1）mm/s 的速度垂直于电池极板方向施压，直至电池电压变为 0V 或变形量达到 30%或挤压力达到 200kN 后停止挤压，观察 1h。 A cell is charged in accordance with 3.1.2, crushed by a plate (a half cylinder with the radius of 75mm and length is longer than the cell's) in the vertical direction at a rate of (5±1)mm/s until the voltage drops to 0V or the cell's deformation rate increases to 30% or the pressure increases to 200kN, and then observed for 1h .	不爆炸、不起火 No explosion, No fire
7	针刺 Puncture Test	电池按 3.1.2 规定充电结束后，用 1 个直径 5mm~8mm 的钢针以（25±5）mm/s 的速度从垂直于电池极板的方向贯穿电池(靠近所刺面的几何中心)，并把钢针停留在电池内，观察 1h。 A cell is charged in accordance with 3.1.2, punctured through (near the geometric center of the surface) by a nail which diameter of 3mm at a rate of 25±5 mm/s, the nail stay within the cell.， and then observed for 1h.	不爆炸、不起火 No explosion, No fire
8	海水浸泡 Seawater Immersion	电池按 3.1.2 规定充电结束后，将电池完全浸没入 3.5%NaCl 溶液中 2h。 A cell is charged in accordance with 3.1.2, completely soaked into the 3.5% NaCl solution for 2h.	不爆炸、不起火 No explosion, No fire
9	低气压 Low Pressure	电池按 3.1.2 规定充电结束后，在室温下将电池放入气压为 11.6kPa 的低气压箱中，静置 6h 后，观察 1h。 A cell is charged in accordance with 3.1.2, stored in a case with the low pressure of 11.6kPa at room temperature for 6 hours, then observed for 1h.	不爆炸、不起火、不漏液 No explosion, No fire, No leakage
10	温度循环 TemperatureCycling	电池按 3.1.2 规定充电结束后，放入温度箱中，温度按照下表进行调节，循环 5 次后，观察 1h。 A cell is charged in accordance with 3.1.2, stored in a temperature box, regulating temperature as the following table, observed for 1 h after cycling 5 times	不爆炸、不起火、不漏液 No explosion, No fire, No leakage

		温度(℃) Temperature	时间增量 (min) IncrementalTime	累计时间 (min)Total Time	温度变化率 (℃/min) Temperature Rate	
		25	0	0	0	
		-40	60	60	13/12	
		-40	90	150	0	
		25	60	210	13/12	
		85	90	300	2/3	
		85	110	410	0	
		25	70	480	6/7	

6. 电池使用时危险、警告及注意事项 Danger ,Warning and Caution in Handing the Cell

6.1 推荐使用事项 Recommending Usage

6.1.1 使用电池前，请仔细阅读使用说明书和电池表面标识。

Please read the cell instructions and the label on its surface before use.

6.1.2 在使用过程中，环境温度超过**35**℃，应该对电池进行降温，应远离热源、高压，避免儿童玩弄电池，切勿摔打电池。

When in use, the environment temperature is over 35℃，the cell shall be cooled, kept out of heat, high voltage and avoided children's touching. Do not drop the cell.

6.1.3 应使用制造商认可的充电器和充电程序，不恰当的充电方式会导致电池发热或损坏。

Use only approved chargers and procedures, improperly charging a cell may cause to flame or damage.

6.1.4 切勿将电池正负极短路，切勿自己拆装电池，也勿让电池放在受潮处，以免发生危险。

Do not touch contacts together. Do not demolish or assemble the cell by yourself. Do not put the cell in the damp

place.

6.1.5 长期不用时，请将电池储存完好，应让电池保持半荷电状态。请用不导电材料包裹电池，以避免金属直接接触电池，造成电池损坏，将电池保存在阴凉干燥处。

When the cell was stored for a long period, put it well in its half capacity. Do not wrap it with conduct material

to avoid the damage caused by the direct contact between the metal and cell. Keep the cell in day places.

6.1.6 废弃电池请安全妥当处理，不要投入火中或水中。

Safely disposed the disused cell. Do not put it into fire or water.

6.2 危险警告 **Hazard Warning**

6.2.1 禁止拆解电池 **Forbid Disassemble Batteries**

自行拆解会造成电池发热、冒烟、变形或燃烧。

Disassemble the battery will cause the battery heat, smoke, deformation or burn.

6.2.2 禁止让电池短路 **Forbid Short-circuit Batteries**

不要将电池的正负极用金属连接，也不要将电池与金属片放在一起存储和移动。如果电池被短路，将会有超大电流流过，将会损坏电池，造成电池发热、冒烟、变形或燃烧。

Do not connect the cell's positive and negative with metal. Do not put the cell with metal together either storage or movement. If the cell is short circuit, there will be a large current flows through the cell, will cause the battery heat, smoke, deformation or burn and damage the cell.

6.2.3 严禁加热和焚烧电池 **Forbid Heat and Burn the Cell**

加热和焚烧电池将会造成电池隔离物的熔化、安全功能丧失或电解质燃烧，过热就会使电池发热、冒烟、变形或燃烧。

If heating or burning the cell, it will caused the isolated element in the cell dissolved, protection function stopped or the electrode burning, over heated, which will make the cell heat, smoke, distort or burning.

6.2.4 避免在热源附近使用电池 **To Avoid Use the Cell near the Heat**

不要在火源、烤炉附近或超过 80℃的环境中使用电池，过热将会导致电池内部短路，使电池发热、冒烟、变形或燃烧。

Do not use the cell near the fire, stove, or the environment temperature is over 80℃, and overheating will cause 11/13 the cell internal short-circuit and make it heat, smoke, distort or burning.

6.2.5 禁止弄湿电池 **Forbid Bathing the Cell**

不要弄湿电池，更不能将电池投入水中，否则会造成电池内部保护电路和功能丧失及发生不正常的化

学反应，电池有可能发热、冒烟、变形或燃烧。

Do not dampen the cell, or even immerse it in the water, which will cause internal protection circuit and its function lost or abnormal chemical reactions, which will lead to heating, smoking, distortion or burning.

6.2.6 使用非专用充电器给电池充电，会发生危险 **Danger in Using Non-indicated Chargers to Charge the Cell**

不要使用高于本规格书规定的最大电流或电压充电。严禁反充电池（正负极接反）。在非正常的条件下充电会造成电池内部保护电路功能丧失和发生不正常的化学反应，电池有可能发热、冒烟、变形或燃烧。

Do not charge the cell with a current or voltage higher than the specified maximum value in this specification. Prohibit reverse charging of the cell. Charging in abnormal condition, will cause internal protection circuit and its function lost or abnormal chemical reactions, which will lead to heating, smoking, distortion or burning.

6.2.7 禁止破坏电池 **Forbid Damage Cell**

禁止用金属凿入电池、锤打或摔打电池或其他方法破坏电池，否则会造成电池发热、冒烟、变形或燃烧，甚至会发生危险。

Do not allow damage the cell with the metals gouged, forged or dropped etc.，otherwise, it will cause overheating, distort, smoke or burning, even in danger.

6.2.8 禁止在电池主体上直接焊接 **Forbid directly welding on the Cell**

过热将会造成电池隔离物的熔化、安全保护功能丧失，使电池发热、冒烟、变形或燃烧。

Over-heated will cause the isolated element dissolved in the cell and losing protective function, even will cause overheating, distort, smoke or burning.

6.2.9 不要直接触及漏液电池 **Do not Touch the Leak-out Cell**

渗漏的电解液会造成皮肤不适，万一电解液进入眼睛，尽快用清水冲洗，不可揉眼，并迅速送医院处理。

The leak-out electrolyte will cause the skin uncomfortable. If it drops into eyes, do not rob the eyes but wash in time, and go to hospital for treatment immediately.

6.2.10 不要混用电池 **Do not Mixed-using Cells**

不要将不同型号的电池混合一起，避免将新的和旧的或不同型号、不同规格、不同化学成分的电池配对使用。Avoid of old and new or different types, different specifications and different chemical composition of the

cells matching use.

6.2.11 其它注意事项 **Other Warnings**

不要将电池放入微波炉、洗衣机或者烘干机里；不要使用已经损坏的电池。

Do not put the cell into microwave, washing machine or drying machine. Do not use a damaged cell.

6.2.12 其它 **Others**

如不按以上规定操作导致发生意外，本公司不承担相应责任。

YLE shall make no liability for problems that occur when the above specifications are not followed.

7. 保质期及产品责任 Period of Warranty and Product Liability

电池的保质期：从出厂日期（喷码）开始起 180 天。如果有证据表明电池的缺陷是在制造过程中形成的，而不是由于用户滥用及错误使用造成的，本公司负责退换电池，否则本公司不承诺免费更换。

Warranty period of this product is 180 days from manufacturing code. We guarantee to give a replacement in case of cells with defects proven due to the manufacturing process instead of abuse and misuse by the customers，otherwise, YLE are not promised free replacement.

8. 贮存 Storage

电池应贮存在温度为-5℃~28℃，相对湿度≤90%的清洁、干燥、通风的环境中，应避免与腐蚀性物质接触，远离火源及热源。并且应使电池处于 50%~60%的荷电状态。如长时间贮存，建议每半年充电一次以防止电池过放电。

The cell shall be stored in the clean and dry ventilation room at the temperature of -5℃～28℃ and shall be kept out of fire or heat and avoid touching corrosion elements. The cell should be stored with 50%~60% charged condition. We recommend that cells should be charged about once per half a year to prevent over-discharge.

9. 运输注意事项 Shipment Requirement

电池应在温度-5℃~28℃，荷电 50%~60%状态下包装成箱进行运输，在运输过程中应防止剧烈振动、冲击或挤压，防止日晒雨，应适用汽车、火车、轮船、飞机等普通运输工具。

The cell should be packed in cartons under the condition of 50%~60% and at the temperature of -5℃～28℃charged for shipment. The violent vibration, impaction or squeezing should be avoided in the transport process;

Avoid to be exposed to the sun and rain. The cells shall be shipped by normal transportation such as by road, by train, by ocean or by air.

10. 其它化学反应 Other Chemical Reactions

电池利用的是化学反应的原理，即使存放很长一段时间不使用，电池的性能也会随时间的增加而降低。如果使用条件如充电、放电及周围环境温度等情形不在指定的使用范围内，会缩短电池的使用寿命，或者会产生漏液导致设备损坏。如果电池长时间不能充电，即使充电方法正确，也需要更换电池了。

Because batteries utilize chemical reaction, cell 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 cell may be shortened or the device in which the cell used may be damaged by electrolyte leakage. If the batteries cannot maintain a charge for long periods of time, even they are charged correctly, this may indicate it is time to change the cell.

11. 电池结构示意图 Scheme of the Cell Structure

12. 备注 Remark

本说明书未包括事项应由双方协议确定。

Any other items which are not covered in this specification shall be agreed by both sides.