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1. Scope

This specification states and describes the characteristics and performance of the Lithium iron phosphate battery manufactured by Bonrex Technology Co., Ltd. ("Bonrex" abbr.) All testes, use and handling of the battery shall be strictly following the specific parameters, conditions and instructions. Please contact Bonrex as follows for any questions.

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2. Standard References

This specification is based on and meets the requirement of GB/T18287-2013, UL1642 and CE61960.

3. Characteristics

Characteristics	Parameters	Conditions
3.1. Nominal Capacity	6000mAh	Standard Discharging, 0.2C ₅ A
3.2. Nominal Voltage	3.2V	-
3.3. Discharge Cut-off Voltage	2.0V	Standard Discharging, 0.2C ₅ A
3.4. Charging Voltage	3.65±0.03V	0°C ~ 45°C
3.5. Standard Charging Current	0.2C ₅ A	0°C ~ 45°C
3.6. Standard Discharging Current	0.2C ₅ A	-10°C ~ +60°C
3.7. Fast Charging Current	0.5C ₅ A	0°C ~ 45°C
3.8. Fast Discharging Current	0.5C ₅ A	-10°C ~ +60°C
3.9. Max Discharging Current	3C ₅ A	Cut-off Voltage @2.0V
3.10. Internal Impedance	≤ 15mΩ	@AC 1 KHz
3.11. Weight	145g	±2g
3.12. Threshold Storage Temperature	≤ 1 month, -20 ~ 45°C	Ex-factory Voltage @3.3 3.45V
	≤ 3 month, 0 ~ 30°C	
	≤ 12 month, 20±5°C	

4. General Test & Performance

Test	Conditions & Procedures	Result & Performance
4.1. Full Charging	<ul style="list-style-type: none"> a. Charge the battery at constant current 0.2C₅A b. Change to constant voltage charging at 3.65V when reaches that voltage c. Stop charging when current gradually decreases to 0.01C₅A d. Pre-set charging time for 8 hrs 	Measured Capacity ≥ Nominal Capacity
4.2. Cycle Life	<ul style="list-style-type: none"> a. Charge and discharge the battery with standard cycle life test b. Stop charging after 2000 cycles and discharge at 0.2C₅A with cut off at 2.0V c. Measure the discharged capacity 	Measured capacity ≥ 80% of Nominal Capacity
4.3. Retention at Storage	<ul style="list-style-type: none"> a. Charge the battery at standard charging condition b. Store for 28 days at 20°C c. Discharge at 0.2C₅A, cut-off at 2.0V 	Retention Rate = Measured capacity / Nominal Capacity ≥ 85%
4.4. Discharging	<ul style="list-style-type: none"> a. Charge the battery at standard charging condition b. Discharge at 0.2C₅A within 1 hr, cutoff at 2.0V 	Capacity ≥ 100% of Nominal Capacity

5. Environmental Test & Performance

Test	Conditions & Procedures	Result & Performance
5.1. Temperature	<ul style="list-style-type: none"> a. Charge the battery at standard charging condition at 20°C b. Discharge at different temp of, <ul style="list-style-type: none"> -10°C 0°C 10°C 20°C 60°C 	Discharged capacity at, -10°C ≥ 55% 0°C ≥ 75% 10°C ≥ 80% 20°C ≥ 90% 60°C ≥ 95% of Nominal capacity
5.2. Constant Temperature & Humidity	<ul style="list-style-type: none"> a. Charge the battery at standard charging condition at 20°C b. Put in a chamber at 40°C & R.H. 90% for 48 hrs c. Discharge at 1C₅A, cut-off at 2.0V 	No obvious deformation No smoke No explosion Discharging time not less than 36 min.

6. Safety Test & Performance

Test	Conditions & Procedures	Result & Performance
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6.1.Short Circuit	<ul style="list-style-type: none"> a. Fully charge the battery at standard charging condition b. Connect with a thermocouple c. Put in test chamber with poles connected, total circuitry resistance $\leq 100\text{m}\Omega$ d. Observe & measure temperature change e. Stop while temperature drops to 10°C from peak 	<p>No fire</p> <p>No explosion</p> <p>Battery's surface temperature $\leq 150^\circ\text{C}$</p>
6.2.Over Charging	<ul style="list-style-type: none"> a. Fully charge the battery at standard charging condition b. Continue to charge at $3C_5A$, constant $4.8V$ for 8 hrs 	<p>No fire</p> <p>No explosion</p> <p>Battery's surface temperature $\leq 150^\circ\text{C}$</p>
6.3.Over Discharging	<ul style="list-style-type: none"> a. Fully charge the battery at standard charging condition b. Discharge at $0.2C_5A$, $20\pm 5^\circ\text{C}$ to cut-off voltage $2.0V$ c. Continue to discharge with a load of 30Ω connected for 24 hrs 	<p>No fire</p> <p>No explosion</p>
6.4.Thermal Shock	<ul style="list-style-type: none"> a. Fully charge the battery at standard charging condition b. Put in hot chamber with temperature increasing at $5\pm 2^\circ\text{C}/\text{min}$ until $130\pm 2^\circ\text{C}$ & then stay for 30 min 	<p>No fire</p> <p>No explosion</p>

7. Standard Testing Conditions and Requirements

7.1. Temperature & Humidity

All testes should be done according to the following conditions, otherwise as of required.

7.1.1. Temperature range of $15\sim 35^\circ\text{C}$

7.1.2. Relative Humidity at $45\sim 75\%$

7.2. Measuring Instrument

7.2.1. Dimension Measuring : Caliper with range of $0\sim 100\text{mm}$, precision at 0.01mm

7.2.2. Voltage Measuring : Voltmeter with range of $0\sim 20V$, precision at $0.01V$

7.2.3. Current Measuring : Ammeter with range of $0\sim 10A$, precision at $\pm 0.4\%$

7.2.4. Impedance Measuring : Battery Impedance Tester, $1\text{ KHz} \pm 10\%$

8. Appearance

The battery should be free of defects such as leakage, rust and deformation. There should be no fire, and no explosion on general performance test while shall be referred to the state and conditions when it is gone through all other testes.

9. Packaging & Transportation

9.1. Pre-shipment inspection

The battery should be checked and passed on voltage, resistance and the function of protection circuit before packing and forward to ship.

9.2. Packaging

The battery is recommended and should be packed per UN38.3 instructions

9.3. Transportation

The battery shall be charged in half of State-of-Charge during ex-factory for transportation. During transportation, it should be free of severe vibration, shocking, extrusion, direct sunshine and rain. It is recommended to go through performance test prior to use of battery while is prohibited to use if damage found such as leakage, deformation, due to transportation.

10. Safety Precaution & Prohibitions

In order to prevent battery leakage, heating, fire, reduced performance or life drops, explosion and other accidents, please follow the provisions of normal use of the battery and comply with preventive matters.

10.1. Charging

10.1.1. Charging Current

Charging current should not be exceeded the maximum value specified in characteristics. Charging with higher current than recommended value may cause damage to battery's electrical, mechanical and safety performance and could lead to heat generation or leakage.

10.1.2. Charging Voltage

Charging voltage should not be exceeded the maximum value specified in the specification details and any intention for higher voltage charging must be strictly prohibited.

Any charger for the charging shall be designed to comply with this condition. It is very dangerous for charging beyond maximum voltage value, which may cause damage to the battery electrical, mechanical safety performance and could lead to heat generation, leakage or explosion.

10.1.3. Charging Temperature

The battery should be charged within range of 0~45°C as stated in characteristics.

10.2. Reverse Charging

Reverse charging is always strictly prohibited. The battery shall be always connected correctly that the polarity must be confirmed before wiring. In case of improper connection, the battery cannot be charged. Reverse charging may also damage battery which may lead to performance degradation, safety issue that may lead to unwanted heat generation, leakage or explosion.

10.3. Discharging

10.3.1. Discharging Current

The battery should be discharged at current not exceeding the maximum discharge current specified in characteristics, otherwise may reduce the discharging capacity significantly or cause it over-heated.

10.3.2. Discharging Temperature

The battery should be discharged within 0~45°C range specified in characteristics.

10.3.3. Over-Discharging

It should be noted that the battery would be at over-discharged state by its self-discharge characteristic when it is not used for a long time. In order to prevent that state, it should be charged periodically to maintain a voltage between 3.0~3.45V. Over-discharging may cause loss of performance, characteristics, or functionalities.

Any charger for the charging shall be equipped with over-charging and over-discharging protection with respect to the cut-off voltage specified in specification details.

11. Storage

The battery must be handled safely and carefully at the point when it is produced. It is totally prohibited to use it if any unusual conditions found such as deformation, leakage or odor. It should be kept away from fire to avoid an explosion due to over-heated.

11.1. Storage Temperature and Humidity

The battery shall be stored according to the storage conditions in characteristics. It is also recommended to store at temperature range of 5~35°C, R.H. of 25~75% and in an environment of clean, dry and free of corrective substances.

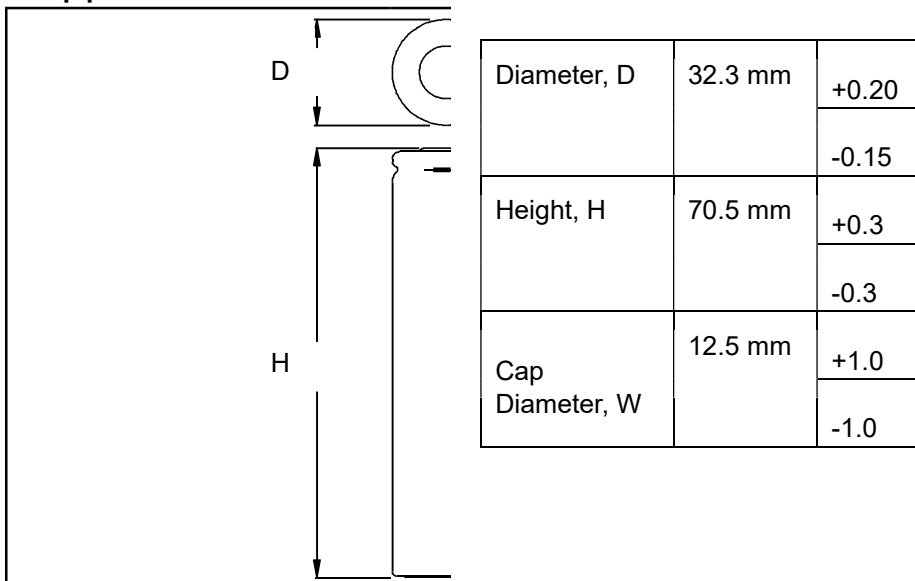
11.2. Long Time Storage

The battery shall be kept at temperature range of -5~25°C if it would be stored for a long time and in an environment of clean, dry and free of corrective substances. It should also be charged and discharged in a complete cycle to retain a voltage of 3.3V for every 3 month.

12. Guarantee Period of Quality

The battery is under guarantee period of quality within two year from date code. It would only be replaced if manufacturing issue found, otherwise any claim, such as damage due to misuse or mishandling, is not accepted.

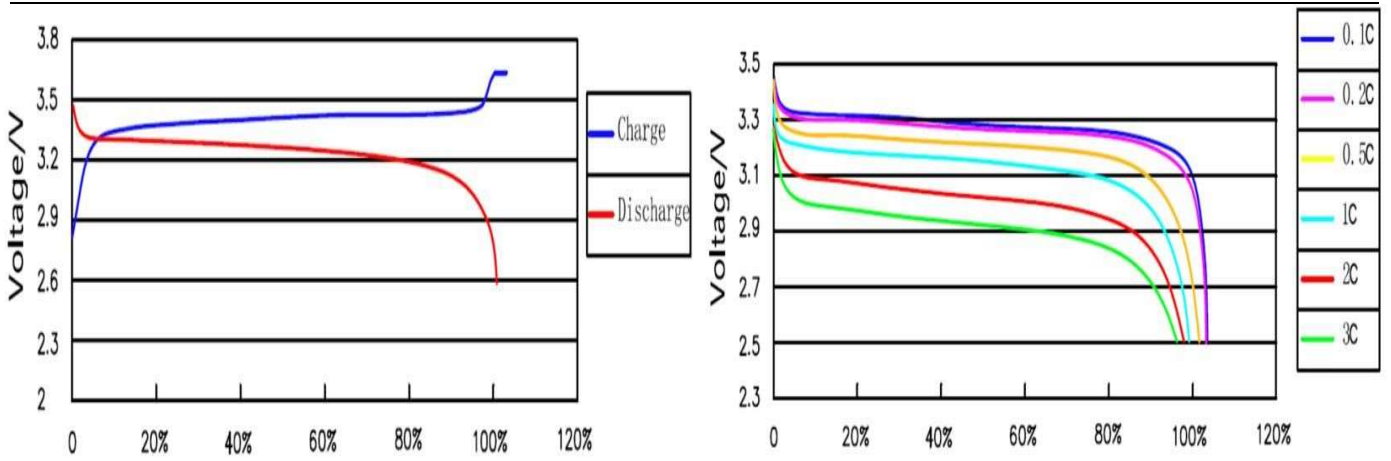
13. Appearance and Dimension



14. Charging & Discharging Curve

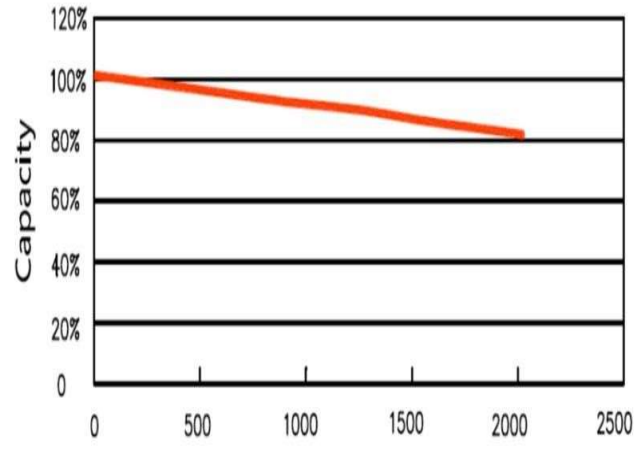
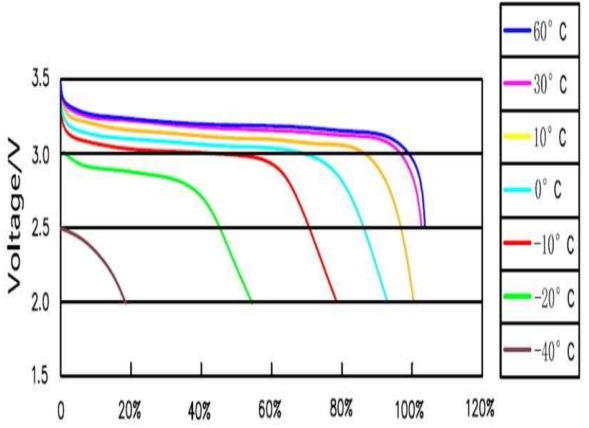
Standard Charging / Discharging @0.5C

High Rate Discharge



High Temperature Discharge @0.5C

Service Life @0.5C Discharging



15. Appendix

Approval Sheet

Product : Rechargeable Lithium IronPhosphate (LiFePO₄) Battery

Customer :

Customer ID :

Model No. : IFR32700N60

Doc No. : BR0415-R01-IFR32700N60

Customer Approval

Signature	Approval Date
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This is to confirm and accept the specification when signed that any changes must be reviewed and agreed by both customer and manufacturer and confirmed with new approval sheet.

Manufacturer Approval

Revision	Prepared by	Reviewed by	Approved by
R01			

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