

UN38.3 Test Summary

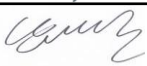
Manufacturer's contact information	LG Energy Solution, Ltd. 188, Munji-ro, Yuseong-gu, Daejeon, 34122, Rep. OF KOREA Telephone : +82-10-7742-5427 E-mail : kkammy@lgensol.com Website : www.lgensol.com		
Test Laboratory information	LG Energy Solution, Ltd. 188, Munji-ro, Yuseong-gu, Daejeon, 34122, Rep. OF KOREA Telephone : +82-10-3842-0138 E-mail : Paradiso@lgensol.com Website : www.lgensol.com		
Description		List of Test Completed	
Item / Type	Lithium ion Battery / Pouch	Revised edition	Revision 6 Amendment 1
Test Report Number	QDI-200130-B-JLR X590 BEV	Test 1. Altitude Simulation	Pass
Date of test report	2020. 01. 30	Test 2. Thermal Test	Pass
Model name	JLR X590 BEV Li-ion Battery module	Test 3. Vibration	Pass
Nominal voltage	10.8 V	Test 4. Shock	Pass
Capacity / Energy	232 Ah / 2.5 kWh	Test 5. External Short Circuit	Pass
Weight	12.2 kg	Test 6. Crush	Pass
Dimensions	357.0(L)*151.0(W)*108.5(H) mm	Test 7. Overcharge	Not applicable
Reference to assembled battery testing requirements	APJLRX590-A1-D01 (389V, 610kg, 232Ah, 2311*1456*335mm)	Test 8. Forced Discharge	Pass

Reviewed By: Jae Seung Lee
Professional
Global Standard Certification Team
LG Energy Solution, Ltd.
E-mail: Paradiso@lgensol.com



Approved By: DaeHo Nam
Team Leader
Global Standard Certification Team
LG Energy Solution, Ltd.
E-mail: kkammy@lgensol.com



Document Number	QDI-200130-B-JLR X590 BEV [UN] Test Report	
Prepared	Taekyun Lim	
Reviewed	Jaeseung Lee	
Approved	DaeHo Nam	

UN38.3 Test Report

- JLR X590 BEV (10.8 V, 232 Ah) -

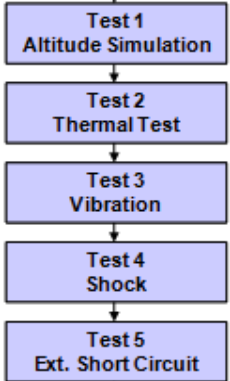
Index

1. UN38.3 Test Condition
2. Test Result
3. Sample Image

2020. 01. 30

1. UN38.3 Test Condition

Rev.6 Amendment 1

Test item	Test Condition	Requirements	Etc.
Test 1. Altitude Simulation	Storing at (low pressure)11.6kPa for 6hr at 20±5°C	- After OCV (%) ≥ 90% - No leakage, no venting, no disassembly, no rupture, no fire - Mass loss limit (leakage) 1) If M<1g, less than 0.5%, 2) If 1g≤M≤75g, less than 0.2%, 3) If M>75g, less than 0.1%	T1~T5 : Sequence Tests  <pre> graph TD T1[Test 1 Altitude Simulation] --> T2[Test 2 Thermal Test] T2 --> T3[Test 3 Vibration] T3 --> T4[Test 4 Shock] T4 --> T5[Test 5 Ext. Short Circuit] </pre>
Test 2. Thermal Test	[72±2°C,12hr ↔ -40±2°C,12hr, interval max. 30min] x 10cycle , Storing at 20±5°C for 24h		
Test 3. Vibration	[7Hz↔200Hz↔7Hz, in 15min] x 12 times x 3 direction 1) sinusoidal waveform with a logarithmic sweep 2) 7Hz~18Hz (maintaining 1gn) app. 25Hz (until 2gn) 200Hz (maintaining 2gn), 1.6mm total excursion		
Test 4. Shock	Half sine shock 1) Peak acceleration - For batteries (whichever is smaller) : 50gn or $\sqrt{\frac{30000}{Mass(kg)}}gn$ 2) Pulse duration : 11msec 3) 6 direction (±x, y, z) x 3 times		
Test 5. External Short Circuit	1) Samples to be heated to 57±4°C in chamber (Measured on external case) 2) Less than 0.1Ω, ext. short-circuit at 57±4°C 3) 1hr continue after returning to 57±4°C or "has decreased by half of the maximum temperature increase observed during the test and remains below that value" If this assessment is not feasible, the exposure time shall be at least 12hours	- No disassembly, no rupture, no fire within 6 hours after the test - Max. Temp ≤ 170°C	
Test 6. Impact	Φ=15.8±0.1mm bar, 9.1±0.1kg mass, 61±2.5cm height	- No disassembly, no fire within 6 hours after the test - Max. Temp ≤ 170°C	for cylindrical cells (not less than 18mm diameter)
Test 6. Crush	Crushing rate : 1.5cm/s, until 13kN±0.78kN or 100mV drop or 50% deformation		for cylindrical cells (less than 18mm diameter) for prismatic, pouch, coin/button cells
Test 7. Overcharge	Current = Manufacturer's recommended max. continuous charge current X 2 Voltage 1.If charge voltage ≤ 18V, V (min.) = 2 x (max. charge voltage) or 22V. 2.If charge voltage > 18V, V (min.) = 1.2 x (max. charge voltage)	- No disassembly, no fire within 7 days after the test	Batteries not equipped with overcharge protection that are designed for use only in a battery assembly, which affords such protection, are not subject to the requirements of this test
Test 8. Forced Discharge	Discharge at max. discharge current (connecting in series with 12V DC power supply), Duration time = rated capacity/initial test current	- No disassembly, no fire within 7 days after the test	Resistance of Electric Loader 1/Ω = (max. discharge current) / (12 + Initial OCV)

- Tests through T1-T5 shall be conducted in sequence with the same battery.
- Large battery means a cell with a gross mass of more than 12kg

2-1. Test Result_T1~T4

Before			Altitude (T1)					Thermal (T2)					Vibration (T3)					Shock (T4)				
NO.	OCV	Mass (kg)	After OCV (V)	Mass (kg)	After OCV(%)	Mass Loss(%)	Result	After OCV (V)	Mass (kg)	After OCV(%)	Mass Loss(%)	Result	After OCV (V)	Mass (kg)	After OCV(%)	Mass Loss(%)	Result	After OCV (V)	Mass (kg)	After OCV(%)	Mass Loss(%)	Result

A. 1st cycle fully charged state

1	12.500	12.14	12.490	12.14	99.92	0.016	Pass	12.340	12.14	98.80	0.000	Pass	12.340	12.14	100.00	0.025	Pass	12.340	12.14	100.00	0.000	Pass
2	12.490	12.11	12.480	12.11	99.92	0.000	Pass	12.340	12.11	98.88	0.000	Pass	12.340	12.11	100.00	0.033	Pass	12.340	12.11	100.00	0.000	Pass

B. 25th cycle fully charged state

3	12.540	12.09	12.530	12.09	99.92	0.008	Pass	12.390	12.09	98.88	0.000	Pass	12.390	12.08	100.00	0.021	Pass	12.390	12.08	100.00	0.000	Pass
4	12.530	12.12	12.520	12.12	99.92	0.016	Pass	12.380	12.12	98.88	0.000	Pass	12.380	12.12	100.00	0.025	Pass	12.380	12.12	100.00	0.000	Pass

2-2. Test Result_T5

EXT. Short Circuit (T5)			
NO.	Initial OCV(V)	Max. Temp (°C)	Result

A. 1st cycle fully charged state

1	12.340	77.80	Pass
2	12.340	83.40	Pass

B. 25th cycle fully charged state

3	12.390	85.00	Pass
4	12.380	85.80	Pass

2-3. Test Result_T6 (E58)

TEST RESULTS					
Sample ID	State	VOLTAGE [V]		Max. temp. of external case during test [°C]	Observation of the sample after 6h
		before testing	after testing		
AZ 453-6	after 25 cycles	3,658	3,657	24,1	O
AZ 453-7	after 25 cycles	3,661	3,660	24,2	O
AZ 453-8	after 25 cycles	3,659	3,658	24,1	O
AZ 453-9	after 25 cycles	3,659	3,659	24,0	O
AZ 453-10	after 25 cycles	3,658	3,657	24,1	O
AZ 453-26	at the 1 cycle	3,666	3,666	24,1	O
AZ 453-27	at the 1 cycle	3,666	3,666	24,1	O
AZ 453-28	at the 1 cycle	3,667	3,666	24,1	O
AZ 453-29	at the 1 cycle	3,667	3,667	24,0	O
AZ 453-30	at the 1 cycle	3,669	3,669	24,1	O
Measurement uncertainty:		± 0,01 V		± 0,1°C	
Result:		PASS			

2-4. Test Result_T8 (E58)

TEST RESULTS					
Discharge time 3 h			Current I _t = 19,33 A		
Sample ID	State	Sample observation	Sample ID	State	Sample observation
AZ 453-11	after 25 cycles	O	AZ 453-31	at the 1 cycle	O
AZ 453-12	after 25 cycles	O	AZ 453-32	at the 1 cycle	O
AZ 453-13	after 25 cycles	O	AZ 453-33	at the 1 cycle	O
AZ 453-14	after 25 cycles	O	AZ 453-34	at the 1 cycle	O
AZ 453-15	after 25 cycles	O	AZ 453-35	at the 1 cycle	O
AZ 453-16	after 25 cycles	O	AZ 453-36	at the 1 cycle	O
AZ 453-17	after 25 cycles	O	AZ 453-37	at the 1 cycle	O
AZ 453-18	after 25 cycles	O	AZ 453-38	at the 1 cycle	O
AZ 453-19	after 25 cycles	O	AZ 453-39	at the 1 cycle	O
AZ 453-20	after 25 cycles	O	AZ 453-40	at the 1 cycle	O
Result:		PASS			

Description phenomenon: D – disassembly; F – fire
Acceptance criteria: O – no phenomenon observed during the test and within 7 days after the test

Test equipment:	DIGATRON tester
NOTE: No deviation from LPB-AZ-04 procedure was employed.	

3. Sample Image

