ampergen
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UN 38.3 CERTIFICATE OF COMPLIANCE

Test Report Number: **UN10-0007** Issue Date: **06-Apr-10**

The following product(s) have been evaluated and found to be in compliance with the Fourth Revised Edition of the UN Manual of Tests and Criteria, Sec. 38.3, Lithium Batteries (ST/SG/AC.10/11/Rev.4):

Customer Part Number(s):	**52-0000-5250-7 TR-332 High Capacity Bat 1/Case**
	70-0715-6359-0 TR-332 High Capacity Bat 1/Case
Ampergen Model Number(s):	**78-8150-0831-9**
Nominal Voltage (V):	**11.1**
Minimum Capacity (mAh):	**4800**
(Equivalent) Lithium Contents (g):	**4.32**
Watt-hour Rating (Li-ion/polymer only) (Wh):	**53.2**

Part Number of Cell Used:	**ICR18650J**
Cell Manufacturer:	**Molicel**

Characteristics of the Tested Product per the Referenced Standard

☑ Battery Pack	☐ Primary (Non-rechargeable)	☑ Small	☐ Prismatic (applies to cells only)
☐ Cell	☑ Secondary (Rechargeable)	☐ Big	☐ Non-prismatic (applies to cells only)

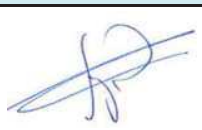
*Small battery is defined as a battery composed of small cells, and in which the aggregate lithium contents of all cell anodes, when fully charged, is not more than 500g.

*Small cell is defined as a cell in which the lithium contents of the anode, when fully charged, is not more than 12g.

*Lithium-equivalent contents for Li-ion cells is calculated as 0.3 times the cell in ampere-hour, with the result expressed in grams. The lithium-equivalent contents of a battery equals the sum of the grams of lithium-equivalent contents contained in the component cells of the battery.

Test Performed	Standard Section	Description	Result (Pass/Fail)	Comments)
T1	38.3.4.1	**Altitude Simulation**	Pass	
T2	38.3.4.2	**Thermal Test**	Pass	
T3	38.3.4.3	**Vibration**	Pass	
T4	38.3.4.4	**Shock**	Pass	
T5	38.3.4.5	**External Short Circuit**	Pass	
T6	38.3.4.6	**Impact (Cell Only)**	Omited	Cell is already UN 38.3 certified
T7	38.3.4.7	**Overcharge**	Pass	
T8	38.3.4.8	**Forced Discharge (Cell Only)**	Omited	Cell is already UN 38.3 certified

Notes:
*See attached UN 38.3 certification for cell.

	COMPILED BY	ENGINEERING	QUALITY CONTROL	MANAGEMENT
Signature:				
Date:	06-Apr-10	06-Apr-10	06-Apr-10	06-Apr-10
Typed Name:	Avisai Esteban	Linh Pham	Jorge Macias	Gary Papas
Title:	Design Engineering	Dir. of Engineering	Sr. QC Manager	General Manager

TEST 1: Altitude Simulation (Section 38.3.4.1)

Test Report Number: **UN10-0007**
Performed By: **A. Esteban**
Test Start Date: **15-Mar-10**
Test Finish Date: **15-Mar-10**

Purpose:
This test simulates air transport under low-pressure conditions.

Test Procedure:
Test batteries shall be stored at a pressure of 11.6kPa (0.116bar) or less for at least 6 hours at ambient temperature (20±5°C).

Test Equipment:

Equipment Type	Equipment Used	Serial Number	Current Calibration
Vacuum Chamber	VWR 1490, P/N 9100845	11062209	N/A
Voltmeter	Hioki 3560	080732566	22-Sep-10
Scale	Acculab ATL-4202-1	24550089	1-Mar-11

Test Data:

Sample	Charge State	Before Test Mass (g)	Before Test Voltage (V)	After Test Mass (g)	After Test Voltage (V)	Mass Loss (%)	Pass/Fail ≤0.1%	Voltage Retention (%)	Pass/Fail ≥90%	Event	Test Comments/Verdict
1	1C	381.88	12.313	381.90	12.303	-0.01%	Pass	99.92%	Pass	0	TEST PASSED
2	1C	381.77	12.313	381.79	12.296	-0.01%	Pass	99.86%	Pass	0	
3	1C	383.60	12.300	383.59	12.288	0.00%	Pass	99.90%	Pass	0	
4	1C	381.62	12.272	381.63	12.260	0.00%	Pass	99.90%	Pass	0	
5	50C	379.95	12.354	379.98	12.339	-0.01%	Pass	99.88%	Pass	0	
6	50C	380.63	12.368	380.63	12.354	0.00%	Pass	99.89%	Pass	0	
7	50C	382.09	12.380	382.07	12.364	0.01%	Pass	99.87%	Pass	0	
8	50C	378.87	12.399	378.85	12.382	0.01%	Pass	99.86%	Pass	0	
9	1D	378.66	10.447	378.68	10.353	-0.01%	Pass	n/a	n/a	0	
10	1D	380.93	10.614	380.93	10.543	0.00%	Pass	n/a	n/a	0	
11	1D	378.85	10.730	378.87	10.671	-0.01%	Pass	n/a	n/a	0	
12	1D	377.17	10.339	377.20	10.230	-0.01%	Pass	n/a	n/a	0	
13	50D	382.46	10.861	382.45	10.830	0.00%	Pass	n/a	n/a	0	
14	50D	381.22	10.989	381.24	10.979	-0.01%	Pass	n/a	n/a	0	
15	50D	381.18	10.722	381.18	10.682	0.00%	Pass	n/a	n/a	0	
16	50D	381.08	10.541	381.08	10.488	0.00%	Pass	n/a	n/a	0	

Code Reference Tables:

Code	Charge State
1C	After 1st cycle, fully charged state
50C	After 50 cycles, fully charged state
1D	After 1st cycle, fully discharged state
50D	After 50 cycles, fully discharged state
U	Undischarged state (fresh battery)
0.5C	1st cycle at 50% of the design rated capacity

Code	Event	T1
0	No leakage or mass loss > 0.1%; voltage retention > 90%	Pass
1	Leakage or mass loss > 0.1%	Fail
2	Voltage retention < 90%	Fail
3	Cell/battery vents as designed without rupture or disassembly	Fail
4	Cell/battery ruptures without ejection of solid material	Fail
5	Cell/battery ruptures with ejection of solid material	Fail
6	Cell/battery ruptures with flame or spark	Fail

TEST 2: Thermal Test (Section 38.3.4.2)

Test Report Number: **UN10-0007**
Performed By: **A. Esteban**
Test Start Date: **16-Mar-10**
Test Finish Date: **22-Mar-10**

Purpose:
This test assesses battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature changes.

Test Equipment:

Equipment Type	Equipment Used	Serial Number	Current Calibration
Temp Shock Chamber	Thermal Shock Chamber TSV-40S	640097	N/A
Voltmeter	Hioki 3560	080732566	22-Sep-10
Scale	Acculab ATL-4202-1	24550089	1-Mar-11

Test Procedure:
Test batteries shall be stored at a temperature equal to 75±2°C for at least 6 hours, then at -40±2°C for at least 6 hours (maximum transition between the 2 temperature ranges must be less than 30 minutes). Repeat 10 cycles, then store samples at ambient temperature (20±5°C) for 24 hours before taking voltage and mass measurements.

Test Data:

Sample	Charge State	Before Test Mass (g)	Before Test Voltage (V)	After Test Mass (g)	After Test Voltage (V)	Mass Loss (%)	Pass/Fail ≤0.1%	Voltage Retention (%)	Pass/Fail ≥90%	Event	Test Comments/Verdict
1	1C	381.90	12.303	381.84	12.292	0.02%	Pass	99.91%	Pass	0	
2	1C	381.79	12.296	381.72	12.291	0.02%	Pass	99.96%	Pass	0	
3	1C	383.59	12.288	383.55	12.280	0.01%	Pass	99.93%	Pass	0	
4	1C	381.63	12.260	381.58	12.252	0.01%	Pass	99.93%	Pass	0	
5	50C	379.98	12.339	379.92	12.320	0.02%	Pass	99.85%	Pass	0	
6	50C	380.63	12.354	380.59	12.338	0.01%	Pass	99.87%	Pass	0	
7	50C	382.07	12.364	382.03	12.347	0.01%	Pass	99.86%	Pass	0	
8	50C	378.85	12.382	378.82	12.364	0.01%	Pass	99.85%	Pass	0	
9	1D	378.68	10.353	378.63	10.277	0.01%	Pass	n/a	n/a	0	**TEST PASSED**
10	1D	380.93	10.543	380.87	10.494	0.02%	Pass	n/a	n/a	0	
11	1D	378.87	10.671	378.81	10.633	0.02%	Pass	n/a	n/a	0	
12	1D	377.20	10.230	377.14	10.141	0.02%	Pass	n/a	n/a	0	
13	50D	382.45	10.830	382.40	10.825	0.01%	Pass	n/a	n/a	0	
14	50D	381.24	10.979	381.18	10.996	0.02%	Pass	n/a	n/a	0	
15	50D	381.18	10.682	381.11	10.669	0.02%	Pass	n/a	n/a	0	
16	50D	381.08	10.488	381.01	10.457	0.02%	Pass	n/a	n/a	0	

Code Reference Tables:

Code	Charge State
1C	After 1st cycle, fully charged state
50C	After 50 cycles, fully charged state
1D	After 1st cycle, fully discharged state
50D	After 50 cycles, fully discharged state
U	Undischarged state (fresh battery)
0.5C	1st cycle at 50% of the design rated capacity

Code	Event	T1
0	No leakage or mass loss > 0.1%; voltage retention > 90%	Pass
1	Leakage or mass loss > 0.1%	Fail
2	Voltage retention < 90%	Fail
3	Cell/battery vents as designed without rupture or disassembly	Fail
4	Cell/battery ruptures without ejection of solid material	Fail
5	Cell/battery ruptures with ejection of solid material	Fail
6	Cell/battery ruptures with flame or spark	Fail

TEST 3: Vibration (Section 38.3.4.3)

Test Report Number: **UN10-0007**
Performed By: **A. Esteban**
Test Start Date: **22-Mar-10**
Test Finish Date: **24-Mar-10**

Purpose:
This test simulates vibration during transport.

Test Equipment:

Equipment Type	Equipment Used	Serial Number	Current Calibration
Vibration Machine	Bruel & Kjaer PA1000L CE	N992 13367/000030	N/A
Voltmeter	Hioki 3560	080732566	22-Sep-10
Scale	Acculab ATL-4202-1	24550089	1-Mar-11

Test Procedure:
Samples are subjected to vibration of sinusoidal waveform with a logarithmic sweep between 7Hz and 200Hz and back to 7Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of 3 mutually perpendicular mounting positions of the sample. 1 of the directions of vibration must be perpendicular to the terminal face. The logarithmic frequency sweep is as follow: from 7Hz a peak acceleration of $1g_n$ is maintained until 18Hz is reached. The amplitude is then maintained at 0.8mm (1.6mm total excursion) and the frequency increased until a peak acceleration of $8g_n$ occurs (approximately 50Hz). A peak acceleration of $8g_n$ is then maintained until the frequency is increased to 200Hz.

Test Data:

Sample	Charge State	Before Test Mass (g)	Before Test Voltage (V)	After Test Mass (g)	After Test Voltage (V)	Mass Loss (%)	Pass/Fail ≤0.1%	Voltage Retention (%)	Pass/Fail ≥90%	Event	Test Comments/Verdict
1	1C	381.84	12.292	381.87	12.280	-0.01%	Pass	99.90%	Pass	0	TEST PASSED
2	1C	381.72	12.291	381.72	12.278	0.00%	Pass	99.89%	Pass	0	
3	1C	383.55	12.280	383.58	12.265	-0.01%	Pass	99.88%	Pass	0	
4	1C	381.58	12.252	381.60	12.240	-0.01%	Pass	99.90%	Pass	0	
5	50C	379.92	12.320	379.90	12.310	0.01%	Pass	99.92%	Pass	0	
6	50C	380.59	12.338	380.61	12.333	-0.01%	Pass	99.96%	Pass	0	
7	50C	382.03	12.347	382.04	12.317	0.00%	Pass	99.76%	Pass	0	
8	50C	378.82	12.364	378.82	12.360	0.00%	Pass	99.97%	Pass	0	
9	1D	378.63	10.277	378.65	10.265	-0.01%	Pass	n/a	n/a	0	
10	1D	380.87	10.494	380.86	10.480	0.00%	Pass	n/a	n/a	0	
11	1D	378.81	10.633	378.86	10.610	-0.01%	Pass	n/a	n/a	0	
12	1D	377.14	10.141	377.15	10.145	0.00%	Pass	n/a	n/a	0	
13	50D	382.40	10.825	382.42	10.820	-0.01%	Pass	n/a	n/a	0	
14	50D	381.18	10.996	381.12	10.953	0.02%	Pass	n/a	n/a	0	
15	50D	381.11	10.669	381.12	10.530	0.00%	Pass	n/a	n/a	0	
16	50D	381.01	10.457	381.05	10.365	-0.01%	Pass	n/a	n/a	0	

Code Reference Tables:

Code	Charge State
1C	After 1st cycle, fully charged state
50C	After 50 cycles, fully charged state
1D	After 1st cycle, fully discharged state
50D	After 50 cycles, fully discharged state
U	Undischarged state (fresh battery)
0.5C	1st cycle at 50% of the design rated capacity

Code	Event	T1
0	No leakage or mass loss > 0.1%; voltage retention > 90%	Pass
1	Leakage or mass loss > 0.1%	Fail
2	Voltage retention < 90%	Fail
3	Cell/battery vents as designed without rupture or disassembly	Fail
4	Cell/battery ruptures without ejection of solid material	Fail
5	Cell/battery ruptures with ejection of solid material	Fail
6	Cell/battery ruptures with flame or spark	Fail

TEST 4: Shock (Section 38.3.4.4)

Test Report Number: **UN10-0007**
Performed By: **A. Esteban**
Test Start Date: **25-Mar-10**
Test Finish Date: **25-Mar-10**

Purpose:
This test simulates possible impacts during transport.

Test Equipment:

Equipment Type	Equipment Used	Serial Number	Current Calibration
Shock Machine	Avco SM-110-3	1022	N/A
Voltmeter	Hioki 3560	080732566	22-Sep-10
Scale	Acculab ATL-4202-1	24550089	15-Nov-10

Test Procedure:
Small batteries are subjected to a half-sine shock of peak acceleration of 150gn and pulse duration of 6 milliseconds.
Each sample shall be subjected to 3 shocks in the positive direction followed by 3 shocks in the negative direction of 3 mutually perpendicular mounting positions of the samples for a total of 18 shocks.
Large batteries shall be subjected to a half-sine shock of peak acceleration of 50gn and pulse duration of 11 milliseconds, 3 shocks in the positive direction followed by 3 shocks in the negative direction of 3 mutually perpendicular mounting positions of the samples for a total of 18 shocks.

Test Data:

☑ Small Battery ☐ Large Battery

Sample	Charge State	Before Test Mass (g)	Before Test Voltage (V)	After Test Mass (g)	After Test Voltage (V)	Mass Loss (%)	Pass/Fail ≤0.1%	Voltage Retention (%)	Pass/Fail ≥90%	Event	Test Comments/Verdict
1	1C	381.87	12.280	381.88	12.700	0.00%	Pass	103.42%	Pass		TEST PASSED
2	1C	381.72	12.278	381.77	12.700	-0.01%	Pass	103.44%	Pass		
3	1C	383.58	12.265	383.59	12.600	0.00%	Pass	102.73%	Pass		
4	1C	381.60	12.240	381.62	12.230	-0.01%	Pass	99.92%	Pass		
5	50C	379.90	12.310	379.98	12.294	-0.02%	Pass	99.87%	Pass		
6	50C	380.61	12.333	380.65	12.312	-0.01%	Pass	99.83%	Pass		
7	50C	382.04	12.317	382.06	12.322	-0.01%	Pass	100.04%	Pass		
8	50C	378.82	12.360	378.80	12.336	0.01%	Pass	99.81%	Pass		
9	1D	378.65	10.265	378.67	10.052	-0.01%	Pass	n/a	n/a		
10	1D	380.86	10.480	380.90	10.322	-0.01%	Pass	n/a	n/a		
11	1D	378.86	10.610	378.89	10.496	-0.01%	Pass	n/a	n/a		
12	1D	377.15	10.145	377.20	10.033	-0.01%	Pass	n/a	n/a		
13	50D	382.42	10.820	382.48	10.724	-0.02%	Pass	n/a	n/a		
14	50D	381.12	10.953	381.27	10.947	-0.04%	Pass	n/a	n/a		
15	50D	381.12	10.530	381.18	10.537	-0.02%	Pass	n/a	n/a		
16	50D	381.05	10.365	381.11	10.287	-0.02%	Pass	n/a	n/a		

Code Reference Tables:

Code	Charge State
1C	After 1st cycle, fully charged state
50C	After 50 cycles, fully charged state
1D	After 1st cycle, fully discharged state
50D	After 50 cycles, fully discharged state
U	Undischarged state (fresh battery)
0.5C	1st cycle at 50% of the design rated capacity

Code	Event	T1
0	No leakage or mass loss > 0.1%; voltage retention > 90%	Pass
1	Leakage or mass loss > 0.1%	Fail
2	Voltage retention < 90%	Fail
3	Cell/battery vents as designed without rupture or disassembly	Fail
4	Cell/battery ruptures without ejection of solid material	Fail
5	Cell/battery ruptures with ejection of solid material	Fail
6	Cell/battery ruptures with flame or spark	Fail

TEST 5: External Short Circuit (Section 38.3.4.5)

Test Report Number: **UN10-0007**
Performed By: **A. Esteban**
Test Start Date: **26-Mar-10**
Test Finish Date: **26-Mar-10**

Purpose:
This test simulates an external short circuit.

Test Equipment:

Equipment Type	Equipment Used	Serial Number	Current Calibration
Thermometer	Arbin BT-2043	150267	10-Aug-10
Temperature Chamber	Thermal Shock Chamber TSV-40S	640097	N/A

Test Procedure:
After the samples' external cases are temperature stabilized at 55±2°C , the samples are to be subjected to a short circuit condition with a total external resistance of less than 0.1Ω at 55±2°C. This short circuit condition is continued for at least 1 hour after the cell or battery external case temperature has returned to 55±2°C. The batteries must be observed for a further 6 hours before stopping the step.

Test Data:

Sample	Charge State	Did case temperature exceed 170°C? Yes/No	Any disassembly or fire within 6 hours? Yes/No	Event	Pass/Fail	Test Comments/Verdict
1	1C	No	No	0	Pass	TEST PASSED
2	1C	No	No	0	Pass	
3	1C	No	No	0	Pass	
4	1C	No	No	0	Pass	
5	50C	No	No	0	Pass	
6	50C	No	No	0	Pass	
7	50C	No	No	0	Pass	
8	50C	No	No	0	Pass	
9	1D	No	No	0	Pass	
10	1D	No	No	0	Pass	
11	1D	No	No	0	Pass	
12	1D	No	No	0	Pass	
13	50D	No	No	0	Pass	
14	50D	No	No	0	Pass	
15	50D	No	No	0	Pass	
16	50D	No	No	0	Pass	

Code Reference Tables:

Code	Charge State
1C	After 1st cycle, fully charged state
50C	After 50 cycles, fully charged state
1D	After 1st cycle, fully discharged state
50D	After 50 cycles, fully discharged state
U	Undischarged state (fresh battery)
0.5C	1st cycle at 50% of the design rated capacity

Code	Event	T1
0	Battery temperature does not exceed 170°C	Pass
1	Battery temperature exceed 170°C	Fail
3	Battery vents as designed without rupture or disassembly	Fail
4	Battery ruptures without ejection of solid material	Fail
5	Battery ruptures with ejection of solid material	Fail
6	Battery ruptures or vents with flame or spark	Fail

TEST 6 (Cell Level Only): Impact (Section 38.3.4.6)

Test Report Number: **UN10-0007**
Performed By:
Test Start Date:
Test Finish Date:

Purpose:
This test simulates an impact.

Test Equipment:

Equipment Type	Equipment Used	Serial Number	Current Calibration
Thermometer	Arbin BT-2043	150267	N/A
15.8mm bar			
9.1kg mass			

Test Procedure:
Cell sample is to be placed on a flat surface. A 15.8mm-diameter bar is placed across the center of the sample. A mass of 9.1kg is dropped from a height of 61±2.5cm onto the sample. A cylindrical or prismatic cell is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8mm-diameter curve surface lying across the center of the test sample. A prismatic cell is also to be rotated 90° around its longitudinal axis so that both the wide and narrow sides will be subjected to the impact. Each sample is subjected to a single impact. Separate samples are to be used for each impact. A coin or button cell is to be impacted with the flat surface of the sample parallel to the and the 15.8mm-diameter curve surface lying across its center.

Test Data:

Sample	Charge State	Did external temperature exceed 170°C? Yes/No	Any disassembly or fire within 6 hours? Yes/No	Event	Pass/Fail	Test Comments/Verdict
1	0.5D			omitted	omitted	**Test OMITTED / Cell is already UN 38.3 certified; see attached report.**
2	0.5D			omitted	omitted	
3	0.5D			omitted	omitted	
4	0.5D			omitted	omitted	
5	0.5D			omitted	omitted	
6	50D			omitted	omitted	
7	50D			omitted	omitted	
8	50D			omitted	omitted	
9	50D			omitted	omitted	
10	50D			omitted	omitted	

Code Reference Tables:

Code	Charge State
1C	After 1st cycle, fully charged state
50C	After 50 cycles, fully charged state
1D	After 1st cycle, fully discharged state
50D	After 50 cycles, fully discharged state
U	Undischarged state (fresh battery)
0.5C	1st cycle at 50% of the design rated capacity

Code	Event	T1
0	Battery temperature does not exceed 170°C	Pass
1	Battery temperature exceed 170°C	Fail
3	Battery vents as designed without rupture or disassembly	Fail
4	Battery ruptures without ejection of solid material	Fail
5	Battery ruptures with ejection of solid material	Fail
6	Battery ruptures or vents with flame or spark	Fail

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TEST 7: Overcharge (Section 38.3.4.7)

Test Report Number: **UN10-0007**
Performed By: **A. Esteban**
Test Start Date: **29-Mar-10**
Test Finish Date: **06-Apr-10**

Purpose:
This test evaluates the ability of a rechargeable battery to withstand an overcharge condition.

Test Equipment:

Equipment Type	Equipment Used	Serial Number	Current Calibration
Power Supply	BK Precision	5221001320	22-Sep-10
Power Supply	BK Precision	5221241421	22-Sep-10
Power Supply	Kikusui PAL 35-10	16013589	03-Aug-10
Power Supply	Power/Mate	0341-5	01-Oct-10

Test Procedure:
The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows:
(a) when the manufacturer's recommended charge voltage is not more than 18V, the minimum voltage of the test shall be the lesser of 2 times the maximum charge voltage of the battery or 22V.
(b) when the manufacturer's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.
Tests are to be conducted at ambient temperature. The duration of the charging test shall be 24 hours. The batteries are observed for another 7 days.

Test Data:

Sample	Charge State	Recom. Charge Current (mA)	Recom. Charge Voltage (V)	Testing Charge Current (mA)	Testing Charge Voltage (V)	Any dissambly or fire within 7 days following test? Yes/No	Event	Pass/Fail	Test Comments/Verdict
1	1C	2600	12.60	5200	22.00	No	0	Pass	**TEST PASSED**
2	1C					No	0	Pass	
3	1C					No	0	Pass	
4	1C					No	0	Pass	
5	50C					No	0	Pass	
6	50C					No	0	Pass	
7	50C					No	0	Pass	
8	50C					No	0	Pass	

Code Reference Tables:

Code	Charge State
1C	After 1st cycle, fully charged state
50C	After 50 cycles, fully charged state
1D	After 1st cycle, fully discharged state
50D	After 50 cycles, fully discharged state
U	Undischarged state (fresh battery)
0.5C	1st cycle at 50% of the design rated capacity

Code	Event	T1
0	Battery did not vent, rupture or disassemble	Pass
3	Battery vents as designed without rupture or disassembly	Fail
4	Battery ruptures without ejection of solid material	Fail
5	Battery ruptures with ejection of solid material	Fail
6	Battery ruptures or vents with flame or spark	Fail

TEST 8 (Cell Level Only): Forced Discharge (Section 38.3.4.8)

Test Report Number: **UN10-0007**
Performed By:
Test Start Date:
Test Finish Date:

Purpose:
This test evaluates the ability of a primary or rechargeable cell to withstand a forced discharge condition.

Test Equipment:

Equipment Type	Equipment Used	Serial Number	Current Calibration
Power Supply	Arbin BT-2043	150267	N/A
Ampmeter			

Test Procedure:
Each cell shall be forced discharged at ambient temperature by connecting it in series with a 12Vdc power supply at an initial current equal to the maximum discharge current specified by the manufacturer. The specified discharge current is to be obtained by connecting a resistive load of the appropriate size and rating in series with the test cell. Each cell shall be forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in amperes).

Test Data:

Sample	Charge State	Rated Capacity (Ah)	Maximum Discharge Current (A)	Testing Charge Current (h)	Any dissambly or fire within 7 days following test? Yes/No	Event	Pass/Fail	Test Comments/Verdict
1	1D					omitted	omitted	**Test OMITTED / Cell is already UN 38.3 certified; see attached report.**
2	1D					omitted	omitted	
3	1D					omitted	omitted	
4	1D					omitted	omitted	
5	1D					omitted	omitted	
6	1D					omitted	omitted	
7	1D					omitted	omitted	
8	1D					omitted	omitted	
9	1D					omitted	omitted	
10	1D					omitted	omitted	
11	50D					omitted	omitted	
12	50D					omitted	omitted	
13	50D					omitted	omitted	
14	50D					omitted	omitted	
15	50D					omitted	omitted	
16	50D					omitted	omitted	
17	50D					omitted	omitted	
18	50D					omitted	omitted	
19	50D					omitted	omitted	
20	50D					omitted	omitted	

Code Reference Tables:

Code	Charge State
1C	After 1st cycle, fully charged state
50C	After 50 cycles, fully charged state
1D	After 1st cycle, fully discharged state
50D	After 50 cycles, fully discharged state
U	Undischarged state (fresh battery)
0.5C	1st cycle at 50% of the design rated capacity

Code	Event	T1
0	Battery did not vent, rupture or disassemble	Pass
3	Battery vents as designed without rupture or disassembly	Fail
4	Battery ruptures without ejection of solid material	Fail
5	Battery ruptures with ejection of solid material	Fail
6	Battery ruptures or vents with flame or spark	Fail

Test Report of UN Transportation

Model: ICR-18650J

In accordance with "AMENDMENTS TO THE THIRD REVISED EDITION OF THE RECOMMENDATIONS ON THE TRANSPORT OF DANGEROUS GOODS, MANUAL OF TESTS AND CRITERIA (Refer to ST/SG/AC.10/11/Rev.3) "

E-One Moli Energy Corp.

(Test Center Group)

Tainan Science-Based Industry Park

No.10 Dail 2nd Rd., Shan-Hwa, Tainan County, Taiwan R.O.C.

Tel: 886-6-505-0666

Fax: 886-6-505-0777

http://www.e-one.com.tw

Loc:\y:\qa\safety issues\un\

Certificate of Compliance

E-ONE MOLI ENERGY CORP.

Tainan Science-Based Industry Park
No.10 Dail 2nd Rd., Shan-Hwa, Tainan County,
Taiwan R.O.C.
Tel: 886-6-505-0666, Fax: 886-6-505-0777
http://www.e-one.com.tw

Issue Date: April 25, 2006

The following products have been tested in accordance with the UN document titled 'AMENDMENTS TO THE THIRD REVISED EDITION OF THE RECOMMENDATIONS ON THE TRANSPORT OF DANGEROUS GOODS, MANUAL OF TESTS AND CRITERIA (Refer to ST/SG/AC.10/11/Rev.3)' and found to comply with the stated criteria:

Item	Product Part No	Rated Capacity
1	ICR-18650J	2.4Ah

All test records are maintained on file at E-One Moli Energy Corp.

Sincerely,

2006/04/25

Product Evaluation Engineer, QA

MATERIAL SAFETY DATA SHEET

Date: 12- Mar- 2013

1. Product and company information

Product name: TR-300 Series LI-ION Rechargeable Batteries

Production code: 78-8150-0830-1 (3-Cell)
78-8150-0831-9 (6-Cell)

Production model: TR-330 (3-Cell)
TR-332 (6-Cell)

Typical Capacity: 2.6Ah (3-Cell)
4.8Ah (6-Cell)

Typical Voltage: 11.1V (both)

Names of the manufacturer or supplier:
Alexander Technologies Europe Limited (ATEL).

Address of the manufacturer or supplier:
4 Doxford Drive
South West Ind. Est
Peterlee
SR8 2RL
United Kingdom

Phone numbers of the manufacturer or supplier:
+44(0)1915872787

2. Hazards identification information

NOTE - Hazards outlined relate to cells contained in the battery pack.

As a solid, these chemicals and metals are contained in a sealed can. For consumer use, exposure to hazardous in gradients is not expected with normal use. Adequate hazard warnings are included on both the package and on the battery. Do not short circuit, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. Risk of fire or explosion. Under normal conditions of use, the electrode materials and liquid electrolyte they contain are not exposed to the outside, provided the battery integrity is maintained and seals remain intact. Risk of exposure only in case of abuse (mechanical, thermal, electrolyte leakage, electrode materials reaction with moisture/water or battery vent/ explosion/ fire may follow, depending upon the circumstance.

Hazard classification: None

3. Ingredients identification information for the cells used within this battery pack

Component	% (w/w)	Exposure Limits[1,2]	LD50	LC50
Dimethyl Carbonate (CAS No. 616-38-6)	3 - 6	Not established	13000 mg/kg (rat/oral) 5000 mg/kg (rabbit/dermal)	Not established
Ethylene Carbonate (CAS No. 96-49-1)	2 - 5	Not established	10400 mg/kg (rat/oral) > 3000 mg/kg (rabbit/dermal)	Not established
Lithium Hexafluorophosphate (CAS No 21324-40-3)	1 – 5	Not established	1702 mg/kg (rat/oral)	>20 mg/kg (rat/4 hour)
Propylene Carbonate (CAS No. 108-32-7)	1 – 4	Not established	29100 mg/kg (rat/oral)	>5000 mg/m3 (rat/4 hour)
Cobalt Lithium Dioxide (CAS No. 12190-79-3)	10 – 45	0.02 mg/m3	Not established	Not established
Graphite (CAS No. 7782-42-5, 7440-44-0)	5 – 20	2 mg/m3	Not established	Not established

1. Exposure Limits are those published by ACGIH, American Conference of Governmental Industrial Hygienists.

2. Exposure limits may vary from time to time and from one jurisdiction to another. Check with local regulatory agency for the exposure limits in your area.

4. The first-aid procedures

First-aid method for different exposure routes.

INHALATION: Remove victim to fresh air. If breathing is difficult a trained person may administer oxygen at a rate of 10 to 15 liters per minute. If breathing has stopped administer artificial respiration by use of a pocket mask or bag valve mask. Do NOT give mouth-to-mouth artificial respiration. Get medical attention immediately.

SKIN CONTACT: Immediately wash skin with soap and copious amounts of water for at least 15 minutes. Remove contaminated clothing and administer a safety shower if contamination of the torso or legs above the knee has occurred. Relief from pain and swelling may be obtained by applying topical ointments after washing. Seek immediate medical advice if significant areas of the body have been affected, or if a severe skin reaction occurs. Treatment must be immediate due to the formation of hydrofluoric acid on moist skin. Launder clothing before reuse and discard leather footwear. Soak permeable belongings in

benzalkonium chloride after washing.

EYE CONTACT: Immediately flush eyes with large volumes of water for at least 15 minutes, holding eyelids open while flushing. Care must be taken not to cross contaminate the eyes. In all cases of eye contact seek immediate medical attention. Continue to flush during transport to a medical facility.

INGESTION: Do not give anything by mouth to a victim who is either unconscious or is losing consciousness. If swallowed, wash mouth with water and have victim spit the wash water out. Repeat. Give one to two glasses of water to wash the throat. Do NOT induce vomiting. If vomiting occurs naturally, have victim lean forward to avoid aspiration. Seek medical attention.

The most important symptoms and hazardous effects: Not applicable

Notes to physicians: If battery is leaking it may cause extremely corrosive HF to be produced upon combustion. Use Ca-gluconate cream or liquid for first-aid.

5. Fire-fighting procedures

Suitable fire extinguishing media:
Dry chemical, alcohol foam, water or carbon dioxide. For incipient fires, carbon dioxide extinguishers are more effective than water.

Specific hazards may be encountered during fire-fighting:
At temperature over 100ºC (212ºF) batteries may burst and release hazardous substances.

Specific fire-fighting program:
Rapidly cool batteries and adjacent structures with water.

Special equipment for the protection of firefighters:
Use SCBA (self-contained breathing apparatus) and full protective gear.

Other:(Decomposition products when exposed to a fire situation.)
Not applicable.

6. Spill disposal procedures

Overview: Evacuate area if fire is present or likely. Spills of the electrolyte from cells pose a risk to the safety of responders if water is present. Contact with water causes the production of extremely toxic and corrosive hydrofluoric acid. Remove all sources of ignition. Electrolyte will remove or soften painted surfaces causing slippiness to be a hazard.

Personal precautions: For all spills, protect skin and eyes from contact with electrolyte. In all cases, wear self-contained breathing apparatus.

Environmental precautions: Prevent from migration into natural waterways. Absorb spilled material with non-reactive absorbent such as vermiculite, clay or earth.

Cleanup Procedures: Evacuate spill area immediately and remove sources of ignition. Do NOT touch spilled material. Cleanup personnel must be trained in the safe handling of this product. If possible ventilate area by means of non-sparking, grounded ventilation system. Spills may be absorbed on non-reactive absorbents such as vermiculite. Place cells into individual plastic bags and then place into appropriate containers and close tightly for disposal. Ensure that cleanup procedures do not expose spilled material to any moisture. Immediately transport closed containers outside. Lined steel drums are suitable for storage of damaged battery packs until proper disposal can be arranged.

7. Safe Handling and storage procedures

Handling Procedures: This product is flammable and corrosive. Reaction products with water are also toxic. Eliminate all ignition sources, (e.g. sparks, open flames, hot surfaces). Keep away from heat. Post. It is very important to keep areas where this material is used clear of other materials which can burn (e.g., cardboard, sawdust). Use non-sparking ventilation systems, approved explosion-proof equipment and intrinsically safe electrical systems in areas of use. To prevent sparking, generously wet hard surfaces before they are chipped, ground, etc, in potentially hazardous areas. Keep aisles and exits free of obstruction. Do not use with incompatible materials such as water, strong oxidizing agents, strong reducing agents, strong acids and strong alkalis. Avoid generating vapour or mists. Prevent the release of vapour and mists into the workplace air. To avoid splashing, carefully dispense into sturdy containers made of compatible materials. Never transfer liquids by pressurizing the original shipping containers with air or inert gas. Do not dispense in storage area unless dispensing area is segregated by fire-resistant construction. Ground all drums, transfer vessels, hoses and piping. Ground clips must contact bare metal. When dispensing in other than a closed system, ensure dispensing container is bonded to receiving transfer equipment and container. Never return contaminated material to its original container. Label containers. Keep containers closed when not in use. Avoid damaging containers. Empty containers may contain hazardous residues.

Storage: Store in a cool, dry, well-ventilated area, out of direct sunlight and away from heat and ignition sources. Inspect all incoming containers to make sure they are properly labelled and not damaged. Store away from water, strong oxidizing agents, strong reducing agents, strong acids and strong alkalis. Store in suitable, labelled containers (usually the shipping container).

8. Exposure controls procedures

Engineering control: General ventilation under normal use conditions.

Control parameters

8-Hour TWAs:	None
Short-term exposure limits:	None
Maximum exposure limits:	None
Biological mark:	None

Personal protective equipment:

Respiratory protection:	None under normal use conditions.
Hand protection:	None under normal use conditions.
Eye protection:	None under normal use conditions. Wear safety glasses when handling leaking batteries.
Skin/body protection:	None under normal use conditions. Use butyl gloves when handling leaking batteries.

Other: Keep batteries away from small children..
Hygiene Methods: Use water cleaning-up.

9. Physical and chemical properties

Physical phase:	Solid
Colour:	Contents silver in color.
Odor:	None
Boiling point:	N/A
Melting point:	N/A
PH value:	N/A
Decomposition temperature:	N/A
Flash point:	N/A
Ignition temperature:	N/A
Explosion limits:	(LEL) NA % (UEL) NA %
Vapour pressure:	1.1-1.3 kPa @ 20ºC
Vapour density:	3.5
Relative Density:	1.2 kg/litre
Solubility:	Miscible in water

10. Stability and reactivity

Possible hazardous reactions occurring under specific conditions:
Contents incompatible with strong oxidizing agents.

Conditions to avoid:
Do not wet, heat, crush, disassemble or short circuit.

Materials to avoid:
Water, heat, acid material.

Hazardous decomposition products:
Hydrogen Fluoride, Phosphorus Oxides, Carbon Monoxide, Carbon Dioxide, Lithium Hydroxide, Cobalt Oxides, Aluminium Oxide, possible fluoro-compounds, Carbon soot.

11. Toxicological information

Acute toxicity:	None
Local effects:	None
Sensitization:	None
Chronic toxicity or long term toxicity:	None

Specific effects: None

12. Ecological information

Possible environmental effects:
Potential subsoil and the ground water pollution.
These batteries pass the U. S. EPA's Toxicity Characteristic Leaching Procedure and therefore, may be disposed of with normal waste.
Environmental toxicity: No data available.
Biodegradability: No data available.

13. Waste disposal procedures

Waste disposal procedures: Always consult and obey all international, federal, provincial/state and local hazardous waste disposal laws. Some jurisdictions require recycling of this spent product.

14. Transport information

Transport procedures: Always consult and obey all international, federal provincial/state and local transport laws.

International Air Transport Association (IATA):

This battery has passed the tests listed in the United Nations Manual of Tests and Criteria, Part III subsection 38.3.

This Lithium Ion battery pack shipped from Alexander Technologies are classified for IATA (AIR) purposes as follows:

Class:	Class 9 Miscellaneous Dangerous Goods
UN Number:	UN3480
Packing Instruction:	PI 965
Packing Group:	Section 1B

Lithium ion batteries subsequently repackaged or reshipped are required to meet all of the requirements specified in the above Packing Instruction.

For further information regarding the IATA regulations for this battery pack please contact Alexander Technologies customer services department

International Maritime Organization (IMO):
This battery has passed the tests listed in the United Nations Manual of Tests and Criteria, Part III subsection 38.3. Not regulated for transport under Special Provision 188 of the International Maritime Dangerous Goods Code (IMDG).

UN 3480 - Lithium ion batteries
UN 3481 - Lithium ion batteries packed with equipment/ Lithium ion batteries contained in equipment

Any Lithium ion cells or batteries subsequently repackaged or reshipped are required to meet all of the requirements specified above.

15. Regulatory information

Applicable regulations：

Local hazardous waste disposal laws.
This product is made from materials with no detectable mercury.

Canadian Federal Regulations:

Canadian Environmental Protection Act: All ingredients in the electrolyte are on the Domestic Substances List
WHMIS Classification: Not controlled, manufactured article

United States Federal Regulations:

Toxic Substances Control Act: All ingredients are listed in the inventory.
OSHA: Does not meet criteria as per Part 1910.1200, manufactured article.
CERCLA: Does not meet criteria
SARA 313: Does not meet criteria
SARA 311/312 EPA Hazard Categories: Does not meet criteria

EU Regulations

EINECS: Not applicable
EU Classification: Not classifiable
Labels: None

16. Other information

Not Applicable