

작성부서	전지)개발팀 원형개발G	등급표시	대외비	
작성자	김영창 전임	작성일자	2009. 2. 20	Page 5

TEST Report of IATA/UN Transportation

Model : ICR18650- 26F

Feb. '2009

Energy Business Division
SAMSUNG SDI

Cell Test Program

Test Item	Test Method	Criteria	Fresh			50cycled
			100%	50%	0%	0%
T-1 Altitude Simulation	11.6Pa for 6h at 20±5°C	No mass loss (not exceed 0.1%) No leakage No venting No disassembly No rupture No fire OCV>90% of the initial voltage	10	-	10	-
T-2 Thermal test	75±2°C for 6h ↔ -40±2°C for 6h (Transfer time : 30min), 10cycle					
T-3 Vibration	7Hz → 200Hz → 7Hz in 15min, 12 cycle for 3h, 3 direction					
T-4 Shock	Half-sine shock of peak acceleration 150g, duration 6ms 3(pos.)shocks → 3(neg.)shocks, 3direction, Total 18 shocks					
T-5 External short circuit	Wire: less 0.1ohm, Case temp. : 55±2°C For 1h or temp. return	Not exceed 170°C No disassembly No rupture No fire within 6h				
T-6 Impact	Flat surface, 15.8mm bar, Weight:9.1kg,Height:61±2.5cm	No disassembly No rupture	-	5(10)	-	5(10)
T-8 Forced discharge	Maximum current(1C) Specified by the manufacturer, 12V DC power supply for 1h (T=capacity / test current)	No disassembly No fire within 7 days	-	-	10	10
Packaging test	1 time/1.2m drop on a concrete surface	-	1 box as same condition with shipment			

- Tests T-1 through T-5 shall be conducted in sequence with the same call
- For test T-6, test should be conducted 5cells along longitudinal axes and 5cells along other axes separately for prismatic cell.

■ T-1~5) Transportation Test for ICR18650-26F

Fresh cell(100% SOC)			After T-1				After T-2				After T-3				After T-4				After T-5	Result
No	Weight(g)	OCV(V)	Weight(g)	Mass loss	Loss %	OCV(V)	Weight(g)	Mass loss	Loss %	OCV(V)	Weight(g)	Mass loss	Loss %	OCV(V)	Weight(g)	Mass loss	Loss %	OCV(V)	Max Temp(°C)	
1	44,6770	4.17	44,6765	0.0005	0.00	4.17	44,6736	0.0029	0.01	4.13	44,6740	-0.0004	0.00	4.13	44,6736	0.0004	0.00	4.12	58.6	OK
2	44,6736	4.17	44,6730	0.0006	0.00	4.17	44,6721	0.0009	0.00	4.13	44,6725	-0.0004	0.00	4.13	44,6722	0.0003	0.00	4.12	57.6	OK
3	44,7467	4.17	44,7458	0.0009	0.00	4.17	44,7435	0.0023	0.01	4.13	44,7455	-0.0020	0.00	4.13	44,7453	0.0002	0.00	4.12	60.7	OK
4	44,6529	4.17	44,6521	0.0008	0.00	4.17	44,6496	0.0025	0.01	4.13	44,6486	0.0010	0.00	4.12	44,6484	0.0002	0.00	4.12	59.6	OK
5	44,6718	4.17	44,6715	0.0003	0.00	4.17	44,6691	0.0024	0.01	4.13	44,6690	0.0001	0.00	4.13	44,6690	0.0000	0.00	4.13	60.1	OK
6	44,6433	4.17	44,6429	0.0004	0.00	4.17	44,6417	0.0012	0.00	4.13	44,6422	-0.0005	0.00	4.13	44,6436	-0.0014	0.00	4.12	57.6	OK
7	44,7069	4.17	44,7063	0.0006	0.00	4.17	44,7034	0.0029	0.01	4.13	44,7009	0.0025	0.01	4.13	44,7005	0.0004	0.00	4.12	57.8	OK
8	44,6228	4.17	44,6223	0.0005	0.00	4.17	44,6205	0.0018	0.00	4.13	44,6221	-0.0016	0.00	4.12	44,6216	0.0005	0.00	4.12	59.9	OK
9	44,7320	4.17	44,7318	0.0002	0.00	4.17	44,7289	0.0029	0.01	4.13	44,7302	-0.0013	0.00	4.13	44,7300	0.0002	0.00	4.12	58.6	OK
10	44,7568	4.17	44,7567	0.0001	0.00	4.17	44,7537	0.0030	0.01	4.13	44,7524	0.0013	0.00	4.12	44,7517	0.0007	0.00	4.12	58.2	OK
Avg.	44,6884	4.17	44,6879	0.0005	0.0011	4.17	44,6856	0.0023	0.0051	4.13	44,6857	-0.0001	-0.0003	4.12	44,6856	0.0002	0.0003	4.12	58.87	OK
Max.	44,7568	4.17	44,7567	0.0009	0.0020	4.17	44,7537	0.0030	0.0067	4.13	44,7524	0.0025	0.0056	4.13	44,7517	0.0007	0.0016	4.13	60.70	OK
Min.	44,6228	4.17	44,6223	0.0001	0.0002	4.17	44,6205	0.0009	0.0020	4.13	44,6221	-0.0020	-0.0045	4.12	44,6216	-0.0014	-0.0031	4.12	57.60	OK

Fresh cell(0% SOC)			After T-1				After T-2				After T-3				After T-4				After T-5	Result
No	Weight(g)	OCV(V)	Weight(g)	Mass loss	Loss %	OCV(V)	Weight(g)	Mass loss	Loss %	OCV(V)	Weight(g)	Mass loss	Loss %	OCV(V)	Weight(g)	Mass loss	Loss %	OCV(V)	Max Temp(°C)	
1	44,6691	3.25	44,6686	0.0005	0.00	3.25	44,6661	0.0025	0.01	3.26	44,6650	0.0011	0.00	3.26	44,6646	0.0004	0.00	3.26	58.4	OK
2	44,6779	3.26	44,6774	0.0005	0.00	3.26	44,6773	0.0001	0.00	3.26	44,6721	0.0052	0.01	3.26	44,6720	0.0001	0.00	3.26	58.2	OK
3	44,7451	3.25	44,7440	0.0011	0.00	3.25	44,7446	-0.0006	0.00	3.25	44,7702	-0.0256	-0.06	3.25	44,7709	-0.0007	0.00	3.25	58.5	OK
4	44,7425	3.26	44,7419	0.0006	0.00	3.26	44,7415	0.0004	0.00	3.27	44,7425	-0.0010	0.00	3.26	44,7430	-0.0005	0.00	3.26	56.7	OK
5	44,6899	3.25	44,6898	0.0001	0.00	3.25	44,6888	0.0010	0.00	3.25	44,6865	0.0023	0.01	3.25	44,6861	0.0004	0.00	3.25	56.8	OK
6	44,6112	3.26	44,6109	0.0003	0.00	3.26	44,6102	0.0007	0.00	3.26	44,6008	0.0094	0.02	3.25	44,6004	0.0004	0.00	3.25	59.4	OK
7	44,6418	3.25	44,6413	0.0005	0.00	3.25	44,6403	0.0010	0.00	3.26	44,6446	-0.0043	-0.01	3.26	44,6443	0.0003	0.00	3.26	57.6	OK
8	44,7268	3.25	44,7265	0.0003	0.00	3.25	44,7250	0.0015	0.00	3.26	44,7254	-0.0004	0.00	3.26	44,7208	0.0046	0.01	3.26	59.7	OK
9	44,6510	3.27	44,6509	0.0001	0.00	3.27	44,6482	0.0027	0.01	3.26	44,6497	-0.0015	0.00	3.26	44,6499	-0.0002	0.00	3.26	59.4	OK
10	44,6925	3.26	44,6925	0.0000	0.00	3.26	44,6900	0.0025	0.01	3.25	44,6903	-0.0003	0.00	3.25	44,6899	0.0004	0.00	3.25	60.6	OK
AVG	44,6848	3.26	44,6844	0.0004	0.00	3.26	44,6832	0.00118	0.00	3.26	44,6847	-0.0015	0.00	3.26	44,6842	0.0005	0.00	3.25	58.53	OK
Max.	44,7451	3.27	44,7440	0.0011	0.0025	3.27	44,7446	0.0027	0.0060	3.27	44,7702	0.0094	0.0211	3.26	44,7709	0.0046	0.0103	3.26	60.60	OK
Min.	44,6112	3.25	44,6109	0.0000	0.0000	3.25	44,6102	-0.0006	-0.0013	3.25	44,6008	-0.0256	-0.0572	3.25	44,6004	-0.0007	-0.0016	3.25	56.70	OK

● Sample : 100% Charged – 10 Ea, 0% Charged – 10Ea

$$* \text{ Weight Loss} = \frac{(\text{ weight after n-1_th test}) - (\text{ weight after n_th test})}{(\text{ weight after n-1_th test})} \times 100$$

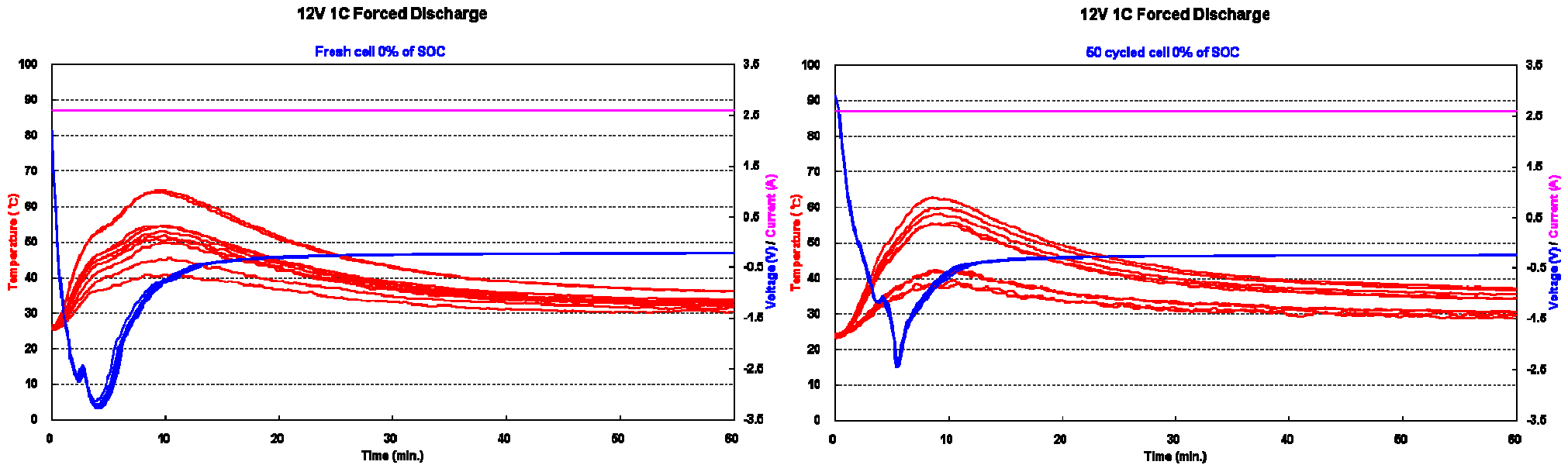
■ T-6) Impact Test for ICR18650-26F

Fresh cell(50% SOC)		After T-6		Result
Cell No	OCV(V)	Max Temp(°C)	Test Result	
1	3,81	24,4	No Leakage	OK
2	3,81	24,1	No Leakage	OK
3	3,81	24,2	No Leakage	OK
4	3,81	24,4	No Leakage	OK
5	3,8	24,2	No Leakage	OK
AVG	3.81	24.26		OK
Max.	3.81	24.40		OK
Min.	3.80	24.10		OK

50cycled cell(0% SOC)		After T-6		Result
Cell No	OCV(V)	Max Temp(°C)	Test Result	
1	2,25	24,2	No Leakage	OK
2	2,25	24,8	No Leakage	OK
3	2,26	24,4	No Leakage	OK
4	2,25	24,1	No Leakage	OK
5	2,24	24,1	No Leakage	OK
AVG	2.25	24.32		OK
Max.	2.26	24.80		OK
Min.	2.24	24.10		OK

- Test method: Drop 9.1kg mass from 61cm height with 15.8mm diameter bar.
- Sample : Fresh Cell – 5 Ea / 50 cycled Cell – 5 Ea
- Test results: 5 No Leakage 5 Leakage only .

T-8) Forced Discharge Test for ICR18650-26F



※ curves shows representative cells

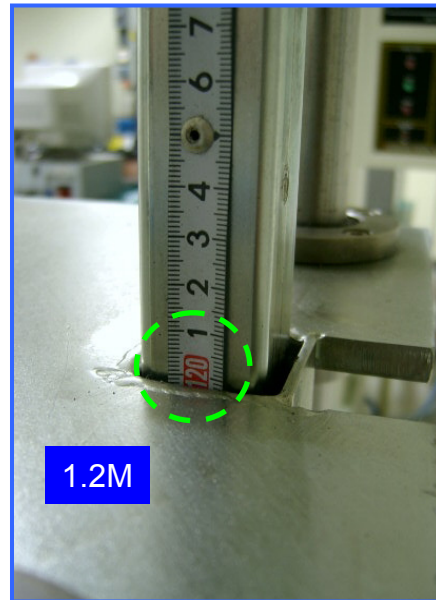
- Test method : 1C, -12V, 1.0Hrs discharge
with 0% charged cell (Fresh cell) & 0% charged cell (50 cycled cell) → 7days storage
- ※ Max discharge current : 1C
- Sample : Fresh Cell – 10Ea / 50 cycled Cell – 10Ea
- Test results : All no Leakage

■ Packaging Drop test - Procedure

- Test Procedure : 1.2m drop in weakest orientation
- Test Method : One Corner/ Three Edge/ Six Flat (Total Ten Times)
- Criteria : No damage to Packs / No shifting of Packs / No release of Packs
- Result : **Acceptable**



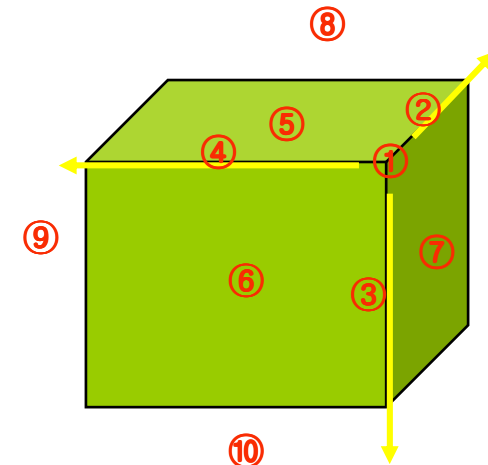
Test machine



Height Setting



Drop



-Test Position

① : Edges

②③④ : Box coner(a datum edges)

⑤⑥⑦⑧⑨⑩ : Box plane

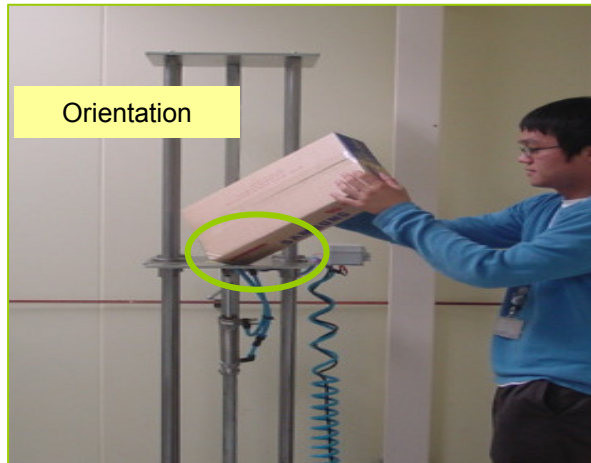
Drop Point

■ Packaging Drop test - Picture

Before Test



On Testing



After Test



Only the box damaged,
Leaving contents intact.

