Battery Pack Test Report
(Package Drop & UN38.3)

Customer: Makita

Pack Model: BL1041B

Nominal voltage: 10.8V~12V(max)

Nominal capacity: 44Wh/4.0Ah

Configuration: 3S2P

Celxpert P/N: 912900069/912900070

Cell Type: Sanyo RX 2000mAh

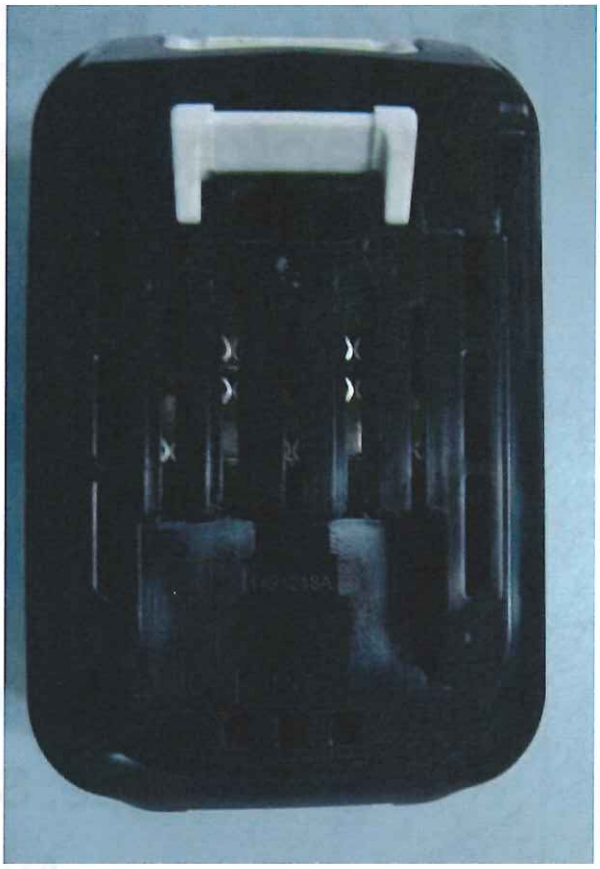
Aug.23 2014

Approved by

Reviewed by

Prepared by

Figure photo of the pack.



1. Package Drop Test Report

Test Period	2014/08/01		Test Spec.	IATA A55 & QS-3Q-043	
Sample Level	Mass Production	Sample Mode	Finished Product	Quantity	2 PCS

1.1 DECSRIPTION OF TEST EQUIPMENTS

Kingdom Technology KD-128AS drop tester. Description of performance:

Payload capacity: 160 lbs. (72.6 kg)

Payload dimensions: Length: 61 cm / Width: 76 cm / Height: 90cm

Drop height range: 30 - 180 cm

Base Plate Material: Solid Steel (Std.)

Base Plate Size: 76.2x114.3x1.3cm

1.2 TEST CONDITION

Drop height: 120cm

Drop weight:0.815Kg

Drop position: One corner, three edges and three faces with 1 time. (Total: 7 drops).

Drop Position and sequence: Ref. attachment 1

1.3 SUMMARY OF TEST

Concluding the follow check items, the result of the test is **pass**.

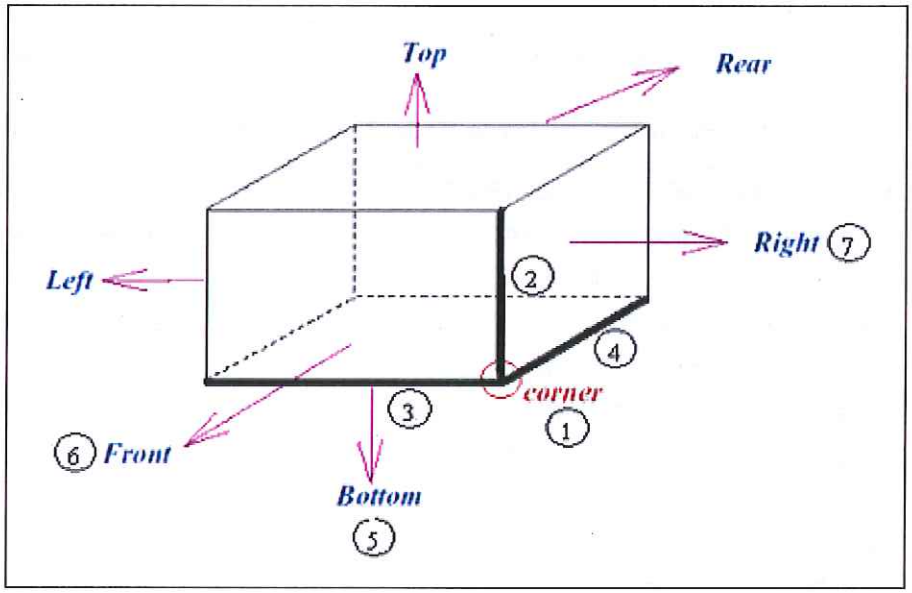
Check items	Before	After
Battery pack function	■Normal□ Fail	■Normal□ Fail
Battery pack appearance	■Normal□ Fail	■Normal□ Fail
Package internal status	■Normal□ Fail	■Normal□ Fail
Package outside status	■Normal□ Fail	■Normal□ Fail

Test photographs please refer to Attachment 2

Function Check details please refer to Attachment 3

Attachment 1:

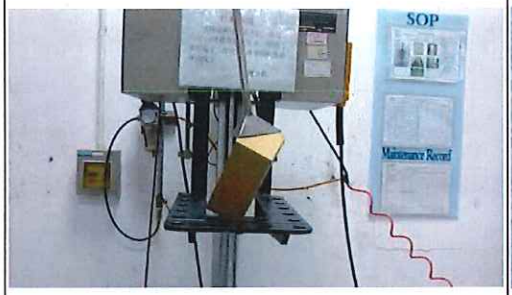
DROP POSITION

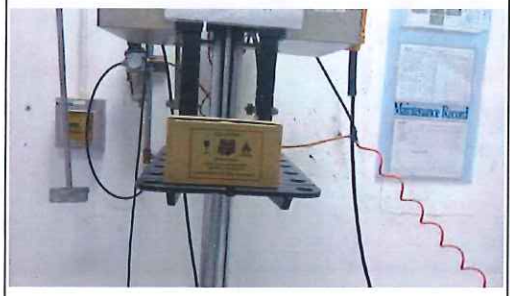
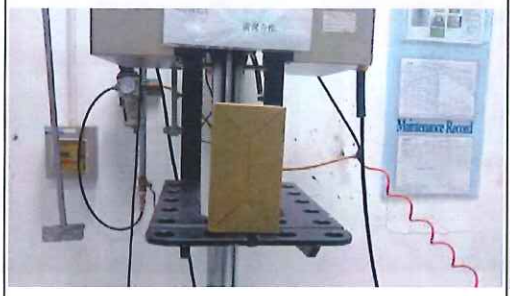
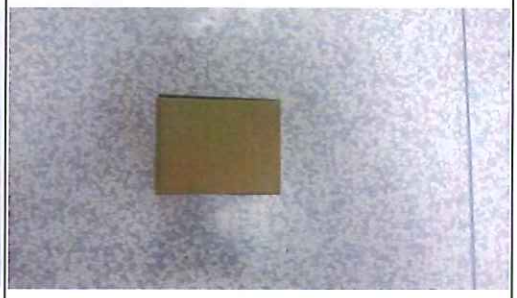


DROP SEQUENCE

DROP	IMPACT SURFACE
1	Corner (2-3-4)
2	Edge 1 (2)
3	Edge 2 (3)
4	Edge 3 (4)
5	Bottom (Flat 5)
6	Front (Flat 6)
7	Right (Flat 7)

Attachment 2:

Drop Sequence	Test Setup	Test Result
1		
2		
3		
4		

Drop Sequence	Test Setup	Test Result
5		
6		
7		

Open Package check for internal after drop test

2. UN38.3 Test Report

Test Period	2014/08/08~2014/8/22		Test Spec.	ST/SG/AC.10/11/Rev.5 Amend.1	
Parts Name	Battery Pack	Application	NB	Quantity	Pack 16PCS/Cell 25pcs

2.1 Test Summary

Item	Test Item	Test Result	Details
T1	Altitude simulation test (UN38.3-1)	Pass	Page 9
T2	Thermal test (UN38.3-2)	Pass	Page 10
T3	Vibration test (UN38.3-3)	Pass	Page 11
T4	Shock test (UN38.3-4)	Pass	Page 12
T5	Short Circuit test (UN38.3-5)	Pass	Page 13
T6	Crush Test (UN38.3-6)	Pass	Page 13
T7	Overcharge test (UN38.3-7)	Pass	Page 14
T8	Forced discharge test (UN38.3-8)	Pass	Page 15

The battery pack passes UN38.3 test.

2.2 Test sample list

No.	Pack S/N	Test item	No.	Cell Num.	Test item
1	Sample No:1/16	38.3.1~5	1	Sanyo RX 2000mAh	38.3.6
2	Sample No:2/16	38.3.1~5	2	Sanyo RX 2000mAh	38.3.6
3	Sample No:3/16	38.3.1~5	3	Sanyo RX 2000mAh	38.3.6
4	Sample No:4/16	38.3.1~5	4	Sanyo RX 2000mAh	38.3.6
5	Sample No:5/16	38.3.1~5	5	Sanyo RX 2000mAh	38.3.6
6	Sample No:6/16	38.3.1~5	6	Sanyo RX 2000mAh	38.3.8
7	Sample No:7/16	38.3.1~5	7	Sanyo RX 2000mAh	38.3.8
8	Sample No:8/16	38.3.1~5	8	Sanyo RX 2000mAh	38.3.8
9	Sample No:9/16	38.3.7	9	Sanyo RX 2000mAh	38.3.8
10	Sample No:10/16	38.3.7	10	Sanyo RX 2000mAh	38.3.8
11	Sample No:11/16	38.3.7	11	Sanyo RX 2000mAh	38.3.8
12	Sample No:12/16	38.3.7	12	Sanyo RX 2000mAh	38.3.8
13	Sample No:13/16	38.3.7	13	Sanyo RX 2000mAh	38.3.8
14	Sample No:14/16	38.3.7	14	Sanyo RX 2000mAh	38.3.8
15	Sample No:15/16	38.3.7	15	Sanyo RX 2000mAh	38.3.8
16	Sample No:16/16	38.3.7	16	Sanyo RX 2000mAh	38.3.8
			17	Sanyo RX 2000mAh	38.3.8
			18	Sanyo RX 2000mAh	38.3.8
			19	Sanyo RX 2000mAh	38.3.8
			20	Sanyo RX 2000mAh	38.3.8
			21	Sanyo RX 2000mAh	38.3.8
			22	Sanyo RX 2000mAh	38.3.8
			23	Sanyo RX 2000mAh	38.3.8
			24	Sanyo RX 2000mAh	38.3.8
			25	Sanyo RX 2000mAh	38.3.8

2.3 Test result

Item	Test Item	Test specification	Judge criteria	Sample(s)
T1	Altitude Simulation (UN38.3-1)	1-1.4 batteries are standard charged. 4 batteries are 1C cycled 50 times, ending in fully charged state. All batteries weight is measured. The charged batteries voltage are measured and recorded. 1-2.Batteries shall be stored at a pressure of 11.6Kpa or less for at least six hours at ambient temperature 20+/-5 ℃. 1-3.Vacuum is released. All cells weight is measured. The charged cell voltage are measured and recorded.	No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire. Battery voltage drop < 10%. Battery resistance change < ±10%.	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)
Test Period		Start: 2014/08/08 End:2014/08/08		
Test Equipment		數位電表 Q153, 電子天平 Q090, 真空烘箱 Q146		
Major Problem		-		
Warning Point		-		
Recommendation		The battery packs pass the test.		

Raw Data

Altitude Simulation Test on Charged Packs

No.	Before			After			Difference			Result
	OCV (V)	Resistance(mΩ)	Weight (g)	OCV (V)	Resistance(mΩ)	Weight (g)	Volt (%)	Resistance(%)	Weight (%)	
1	12.5202	38.56	372.08	12.520	38.86	372.07	0.00%	0.78%	0.00%	Pass
2	12.5208	37.48	372.07	12.520	37.78	372.06	-0.01%	0.80%	0.00%	Pass
3	12.4996	36.92	372.11	12.519	36.72	372.10	0.16%	-0.54%	0.00%	Pass
4	12.5201	38.82	372.04	12.497	39.32	372.03	-0.19%	1.29%	0.00%	Pass
5	12.5203	39.11	372.05	12.518	39.51	372.04	-0.02%	1.02%	0.00%	Pass
6	12.4987	37.39	372.10	12.496	37.89	372.09	-0.02%	1.34%	0.00%	Pass
7	12.4993	36.42	372.09	12.498	36.82	372.08	-0.01%	1.10%	0.00%	Pass
8	12.4854	35.83	372.06	12.485	36.13	372.05	0.00%	0.84%	0.00%	Pass

Item	Test Item	Test specification	Judge criteria	Sample(s)
T2	Thermal test (UN38.3-2)	2-1. Packs are stored for 6 hours at 72±2℃, followed by storage for 6 hours at -40±2℃. The maximum time interval between test temperature extremes is 30 minutes. 2-2.Repeat 2-1 for 10 times. Then store the packs at ambient for 24 hours. All packs weight are measured. The charged battery voltage are measured and recorded.	No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire. Battery voltage drop < 10%. Battery resistance change < ±10%.	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)

Test Period	Start: 2014/08/09 End:2014/08/15
Test Equipment	數位電表 Q153, 電子天平 Q090, 冷熱衝擊機 Q336
Major Problem	-
Warning Point	-
Recommendation	The packs pass the test.

Raw Data

Thermal Test on Charged Packs

No.	Before			After			Difference			Result
	OCV (V)	Resistance(mΩ)	Weight (g)	OCV (V)	Resistance(mΩ)	Weight (g)	Volt (%)	Resistance(%)	Weight (%)	
1	12.5202	38.86	372.07	12.451	39.36	371.97	-0.55%	1.29%	0.03%	Pass
2	12.5198	37.78	372.06	12.444	38.28	371.95	-0.61%	1.32%	0.03%	Pass
3	12.5191	36.72	372.10	12.444	37.12	371.99	-0.60%	1.09%	0.03%	Pass
4	12.4966	39.32	372.03	12.423	39.72	371.93	-0.59%	1.02%	0.03%	Pass
5	12.5183	39.51	372.04	12.447	40.11	371.94	-0.57%	1.52%	0.03%	Pass
6	12.4957	37.89	372.09	12.421	38.29	372.00	-0.60%	1.06%	0.02%	Pass
7	12.4983	36.82	372.08	12.430	37.42	371.99	-0.54%	1.63%	0.03%	Pass
8	12.4854	36.13	372.05	12.410	36.63	371.96	-0.60%	1.38%	0.02%	Pass

Item	Test Item	Test specification	Judge criteria	Sample(s)
T3	Vibration test (UN38.3-3)	3-1. Packs are firmly secured to the platform of the vibration machine without distorting the packs in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of 3 mutually perpendicular to the terminal face. 3-2. The logarithmic frequency sweep is as follows: 7-18 Hz ➔ 1gn 18-50 Hz ➔ 0.8mm amplitude 50-200 Hz ➔ 8gn 3-3. All packs weight are measured. The charged packs voltage are measured and recorded.	No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire. Battery voltage drop < 10%. Battery resistance change < ±10%	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)

Test Period	Start: 2014/08/18 End:2014/08/18
Test Equipment	數位電表 Q153, 電子天平 Q090, 振動測試機 Q300
Major Problem	-
Warning Point	-
Recommendation	The packs pass the test.

Raw Data

Vibration Test on Charged Packs

No.	Before			After			Difference			Result
	OCV (V)	Resistance(mΩ)	Weight (g)	OCV (V)	Resistance(mΩ)	Weight (g)	Volt (%)	Resistance(%)	Weight (%)	
1	12.4512	39.36	371.97	12.444	39.96	371.94	-0.06%	1.52%	0.01%	Pass
2	12.4438	38.28	371.95	12.437	38.88	371.93	-0.06%	1.57%	0.01%	Pass
3	12.4441	37.12	371.99	12.436	37.62	371.97	-0.06%	1.35%	0.01%	Pass
4	12.4226	39.72	371.93	12.415	40.42	371.91	-0.06%	1.76%	0.01%	Pass
5	12.4473	40.11	371.94	12.439	40.81	371.92	-0.06%	1.75%	0.01%	Pass
6	12.4207	38.29	372.00	12.415	38.79	371.97	0.05%	1.31%	0.01%	Pass
7	12.4303	37.42	371.99	12.421	37.82	371.96	-0.07%	1.07%	0.01%	Pass
8	12.4104	36.63	371.96	12.403	37.23	371.93	-0.06%	1.64%	0.01%	Pass

Item	Test Item	Test specification	Judge criteria	Sample(s)
T4	Shock test (UN38.3-4)	4-1. Packs shall be secured to the testing machine by means of a rigid mount, which will support all mounting surfaces. 4-2. Packs shall be subjected to a half-sine shock of peak acceleration 150gn and pulse duration of 6 milliseconds. Each pack shall be subjected to 3 shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicularly mounting positions of the pack for a total of 18 shocks. 4-3. All batteries weight are measured. The charged cell voltage are measured and recorded.	No mass loss (<0.1%), no leakage, no venting, no disassembly, no rupture and no fire. Battery voltage drop < 10%. Battery resistance change < ±10%.	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)

Test Period	Start: 2014/08/19 End:2014/08/19
Test Equipment	數位電表 Q153, 電子天平 Q090, 衝擊測試機 Q154
Major Problem	-
Warning Point	-
Recommendation	The packs pass the test.

Raw Data

Shock Test on Charged Packs

No.	Before			After			Difference			Result
	OCV (V)	Resistance(mΩ)	Weight (g)	OCV (V)	Resistance(mΩ)	Weight (g)	Volt (%)	Resistance(%)	Weight (%)	
1	12.4442	39.96	371.94	12.438	40.46	371.93	-0.05%	1.25%	0.00%	Pass
2	12.4368	38.88	371.93	12.432	39.38	371.92	-0.04%	1.29%	0.00%	Pass
3	12.4361	37.62	371.97	12.431	38.02	371.96	-0.04%	1.06%	0.00%	Pass
4	12.4146	40.42	371.91	12.409	40.72	371.90	-0.05%	0.74%	0.00%	Pass
5	12.4393	40.81	371.92	12.435	41.31	371.91	-0.03%	1.21%	0.00%	Pass
6	12.4147	38.79	371.97	12.408	39.19	371.97	-0.06%	1.03%	0.00%	Pass
7	12.4213	37.82	371.96	12.415	38.42	371.95	-0.05%	1.59%	0.00%	Pass
8	12.4034	37.23	371.93	12.398	37.73	371.93	-0.04%	1.34%	0.00%	Pass

Item	Test Item	Test specification	Judge criteria	Sample(s)
T5	Short Circuit Test (UN38.3-5)	5-1.Packs are placed in to a 55±2℃ oven, and exterior packs temperature are monitored 5-2.When packs exterior reach 55±2℃, they are shorted by connecting terminals with a copper wire of resistance less than 100m Ohm. 5-4. The short was continued for more than 1hour or the cell temperature return to 55℃. The packs are observed for a further 6 hours.	No rupture, no disassembly, no explosion, no fire, no smoke. Packs exterior peak temperature <170℃.	4 packs are standard charged (Pack#1~4) 4 packs 50 cycled ending in fully charged states (Pack#5~8)
Test Period	S Start: 2014/08/20 End:2014/08/22			
Test Equipment	數位電表 Q153, 資料收集器 Q075, 烘箱 Q171			
Recommendation	The packs pass the test.			

Raw Data

Short Circuit Test on Charged Packs

No.	Max. Temp.(℃)	Visual	Result
1	55.84	OK	Pass
2	55.69	OK	Pass
3	55.52	OK	Pass
4	55.17	OK	Pass
5	55.36	OK	Pass
6	55.27	OK	Pass
7	55.67	OK	Pass
8	55.64	OK	Pass

Item	Test Item	Test specification	Judge criteria	Sample(s)
T6	Crush test/ Impact test (UN38.3-6)	6-1.Cell's diameter > 20mm, Execution impact test. (A 9.1 Kg mass is to be dropped from a height of 61±2.5cm onto the sample.) 6-2.Cell's diameter < 20mm, Execution crush test (The cells are crushed with a 13 KN with the crush tester. Once the force is obtained it is to be released.)	External temperature of cell does not exceed 170℃ and there is no disassembly and no fire within 6 hours of the test.	5 cells are 50% charged (Cell #1~5)
Test Period	Start: 2014/08/08 End:2014/08/08			
Test Equipment	數位電表 Q153, 資料收集器 Q152, 擠壓試驗機 Q437			
Recommendation	The Cells pass the test.			

Raw Data

Impact Test on 50% Charged Cells

No.	Max. Temp.(℃)	Visual	Result
1	76.89	OK	Pass
2	84.55	OK	Pass
3	92.37	OK	Pass
4	91.28	OK	Pass
5	87.43	OK	Pass

Item	Test Item	Test specification	Judge criteria	Sample(s)
T7	Overcharge test (UN38.3-7)	7-1. The charge current shall be twice the Spec's recommended maximum continuous charge current. 7-2.The minimum voltage of the test shall be as follows: (a) When the Spec's recommended charge voltage is not more than 18V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22V. (b) When the Spec's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage. 7-3. Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.	No disassembly, no fire within seven days after the test.	4 packs are fully charged (Pack#9~12) 4 packs are 50 times cycled ending in fully charged state (Pack #13~16)
Test Period		Start: 2014/08/18 End:2014/08/21		
Test Equipment		數位電表 Q153, 資料收集器 Q078, 電源供應器 Q148/Q149/Q150		
Major Problem		-		
Warning Point		-		
Recommendation		The packs pass the test.		

Raw Data

Overcharge Test on Charged Packs

No.	Charge Voltage(V)	Charge Current(A)	Max. Temp.(°C)	Visual	Result
9	22.0 V	2.7	22.36	OK	Pass
10			23.17	OK	Pass
11			21.84	OK	Pass
12			21.69	OK	Pass
13			22.03	OK	Pass
14			22.49	OK	Pass
15			22.91	OK	Pass
16			22.11	OK	Pass

Item	Test Item	Test specification	Judge criteria	Sample(s)
T8	Forced discharge test (UN38.3-8)	Cell shall be forced discharged at ambient temperature by connecting it in series with a 12 V D.C. power supply at an initial current equal to the maximum discharge current Specified by the manufacturer.	No disassembly, no fire within seven days after the test.	10 cells are first cycle in fully discharged states (Pack#6~15) 10 cells are after 50 cycles ending in fully discharged states (Pack #16~25)
Test Period	Start: 2014/08/11 End:2014/08/13			
Test Equipment	數位電表 Q153, 資料收集器 Q160, 電源供應器 Q147/Q236/Q237			
Major Problem	-			
Warning Point	-			
Recommendation	The packs pass the test.			

Raw Data

Forced discharge are first cycle in fully discharged				Forced discharge are after 50 cycles ending in fully discharged			
No.	Max. Temp.(℃)	Visual	Result	No.	Max. Temp.(℃)	Visual	Result
6	82.35	OK	Pass	16	93.16	OK	Pass
7	78.94	OK	Pass	17	95.68	OK	Pass
8	64.33	OK	Pass	18	98.24	OK	Pass
9	92.34	OK	Pass	19	88.51	OK	Pass
10	81.12	OK	Pass	20	84.36	OK	Pass
11	85.63	OK	Pass	21	102.34	OK	Pass
12	79.45	OK	Pass	22	100.45	OK	Pass
13	80.53	OK	Pass	23	99.87	OK	Pass
14	77.47	OK	Pass	24	84.17	OK	Pass
15	91.24	OK	Pass	25	86.29	OK	Pass