Test report for primary battery testing for ALDI Stores Australia

Per Lindström

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Summary:

Alkaline primary batteries have been tested in accordance with IEC 60086-2, Ed. 11.0, 2006-12. Test conditions are according to IEC 60086-1 Ed. 10, 2006-12. Discharge time to specified voltage levels has been determined.

Brands	Sizes
Ultracell Max	LR6
Energizer Max	LR6

The test results apply only to the tested samples.

Electronic copy of original report is marked with RE in “Report No R11-021”.

Project leader:	*Approved by:*
Per Lindström	Johny Jonsson

Distribution:

ALDI Stores Australia: David Dimovski

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1. CLIENT

ALDI Stores Australia
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Australia

2. COMMISSION

Testing of alkaline primary batteries according to accredited methods in IEC 60086-2, Ed.11.0, 2006-12.

Project number: 419.101
Project leader: Per Lindström
Operator: Per Lindström

3. TEST SAMPLES

Table 3.1 Test samples

Brand	Type	Delivery date	ES number
Ultracell Max	LR6	2011-03-11	ES11-32
Energizer Max	LR6	2011-03-11	ES11-33

4. TEST PROGRAM

The method in Table 4.1 is according to IEC 60086-2, Ed. 11.0, 2006-12. This method is accredited by SWEDAC.

Table 4.1 Test program

Battery	Application	Load	Daily period	End point (V)
LR6	Photo flash	1000 mA	10 s/min, 1 h/day	0,9
	Electronic game	250 mA	1 h/day	0,9
	Digital camera	1500 mW/650 mW	2 s/28 s, 5 min/h, 24 h/day	1,05

9 samples/test

Determination of discharge time to end voltage.

5. TEST CONDITIONS

Test conditions are according to IEC 60086-1, Ed 10.0, 2006-12.

Testing was performed on a PEC test system BDT1012 for primary batteries. The batteries were connected to the discharge circuits by pressure contacts.

Room temperature:	20 ± 2 °C
Humidity:	45 – 65 %

The time to voltage levels / cut-off voltage was determined by scanning every 25-200 msec and registration with ΔV and Δt. The values for ΔV and Δt are dependent on test regime.

6. TEST RESULTS

Test results are summarized in Table 6.1 below.

Tables showing life of individual batteries, discharged to specified end voltages are compiled in Appendix A.

The time to end voltage is in some tests expressed as pulses. The averages presented in the result tables are calculated from the number of fully completed pulses of each individual test sample.

The test results apply only to the tested samples.

Uncertainty of load resistance, voltage measurement and load current:

The uncertainty of load resistance is calculated to be less than ±0,5 % based on calibrations. The requirement according to IEC 60086-1, Ed. 10.0, 2006-12 is ±0,5 %.

The uncertainty of voltage measurement is calculated to be ≤ 0,25 % based on calibrations. The requirement according to IEC 60086-1, Ed. 10.0, 2006-12 is ≤ 0,25 %.

The uncertainty of load current is calculated to be less than ±0,5 % based on calibrations.

Measurement uncertainty is reported in accordance with the EA publication EA-4/16 "EA guidelines on the expression of uncertainty in quantitative testing", December 2003.

Table 6.1 Summary of test results size LR6.

Type	Load	End voltage	Unit	Ultracell Max			Energizer Max		
				Time or pulses to end voltage			Time or pulses to end voltage		
				Average	Max	Min	Average	Max	Min
LR6	Photo flash 1000 mA, 10 s/min, 1 h/day	0,9 V	(pulses)	**574**	584	540	**403**	467	276
	Electronic game 250 mA, 1 h/day	0,9 V	(h)	**8,24**	8,35	7,93	**8,28**	8,49	7,88
	Digital camera 1500 mW/650 mW, 2 s/28 s, 5 min/h, 24 h/day	1,05 V	(pulses)	**99**	117	89	**70**	77	64

Ultracell Max **LR6**

Date code: **10-2017** **Made in:** **China**

Test No. **13003**

1000 mA, 10 sec/min, 1 h/d

Test starting date: **2011-03-23**

Battery	1,3 V (pulses)	1,2 V (pulses)	1,1 V (pulses)	1,0 V (pulses)	0,9 V (pulses)	0,8 V (pulses)
1	56	120	274	408	577	638
2	57	148	276	410	576	645
3	57	148	275	408	540	636
4	57	152	279	413	581	651
5	56	119	276	411	578	639
6	57	149	277	414	579	649
7	60	153	282	419	584	654
8	54	116	238	403	571	627
9	58	150	279	416	581	644
Average	57	139	273	411	574	643
Std. Dev.	1,62	15,95	13,31	4,80	13,31	8,44
Max. value	60	153	282	419	584	654
Min. value	54	116	238	403	540	627

Ultracell Max				**LR6**		
Date code:	**10-2017**	**Made in:**	**China**			
Test No.	**13004**					
250 mA, 1 h/d						
Test starting date:		**2011-03-23**				
Battery	1,3 V (h)	1,2 V (h)	1,1 V (h)	1,0 V (h)	0,9 V (h)	0,8 V (h)
1	1,56	3,57	5,76	7,50	8,35	8,76
2	1,54	3,55	5,73	7,48	8,35	8,81
3	1,53	3,55	5,74	7,47	8,32	8,81
4	1,54	3,54	5,71	7,48	8,32	8,70
5	1,54	3,54	5,72	7,48	8,31	8,73
6	1,47	3,51	5,72	7,41	8,28	8,76
7	1,49	3,54	5,71	7,47	7,99	8,68
8	1,54	3,54	5,68	6,96	7,93	8,64
9	1,50	3,56	5,74	7,48	8,34	8,79
Average	1,52	3,54	5,73	7,41	8,24	8,74
Std. Dev.	0,03	0,02	0,02	0,17	0,16	0,06
Max. value	1,56	3,57	5,76	7,50	8,35	8,81
Min. value	1,47	3,51	5,68	6,96	7,93	8,64

Ultracell Max **LR6**

Date code: 10-2017 Made in: China

Test No. 13002

1500 mW/650 mW, 2 s/28 s, 5 min/h, 24 h/day

Test starting date: 2011-03-23

Battery	1,3 V (pulses)	1,2 V (pulses)	1,05 V (pulses)	1,0 V (pulses)	0,9 V (pulses)	0,8 V (pulses)
1	26	49	97	116	137	156
2	26	49	98	116	139	158
3	27	49	98	117	139	159
4	25	47	89	107	129	149
5	26	48	97	109	137	156
6	27	49	97	109	137	156
7	27	49	97	109	137	149
8	26	49	98	116	139	159
9	34	57	117	128	148	168
Average	27	50	99	114	138	157
Std. Dev.	2,7	2,9	7,4	6,5	4,8	5,7
Max. value	34	57	117	128	148	168
Min. value	25	47	89	107	129	149

Energizer Max **LR6**

Date code: 03-2017 Made in: Singapore

Test No. 13006

1000 mA, 10 sec/min, 1 h/d

Test starting date: 2011-03-23

Battery	1,3 V (pulses)	1,2 V (pulses)	1,1 V (pulses)	1,0 V (pulses)	0,9 V (pulses)	0,8 V (pulses)
1	37	87	151	239	402	519
2	38	89	154	272	400	513
3	37	86	147	226	342	477
4	46	97	162	282	456	540
5	34	81	116	170	276	415
6	44	95	161	275	414	529
7	47	99	173	295	467	571
8	44	96	173	292	453	569
9	40	90	160	278	413	536
Average	41	91	155	259	403	519
Std. Dev.	4,60	5,99	17,17	40,48	60,71	48,28
Max. value	47	99	173	295	467	571
Min. value	34	81	116	170	276	415

Energizer Max				**LR6**		
Date code:	**03-2017**	**Made in:**	**Singapore**			
Test No.	**13007**					
250 mA, 1 h/d						
Test starting date:		**2011-03-23**				
Battery	1,3 V (h)	1,2 V (h)	1,1 V (h)	1,0 V (h)	0,9 V (h)	0,8 V (h)
1	1,40	2,86	5,71	7,58	8,45	8,86
2	1,39	2,77	5,64	7,46	8,34	8,65
3	1,35	2,71	5,63	7,46	8,35	8,74
4	1,38	2,81	5,78	7,59	8,49	8,91
5	1,35	2,65	5,63	7,46	8,33	8,72
6	1,36	2,73	5,70	7,52	8,41	8,85
7	1,31	2,48	4,65	6,83	7,88	8,52
8	1,26	2,44	4,67	6,89	7,94	8,62
9	1,37	2,76	5,57	7,45	8,32	8,68
Average	1,35	2,69	5,44	7,36	8,28	8,73
Std. Dev.	0,04	0,14	0,45	0,29	0,22	0,13
Max. value	1,40	2,86	5,78	7,59	8,49	8,91
Min. value	1,26	2,44	4,65	6,83	7,88	8,52

Energizer Max **LR6**

Date code: 03-2017 Made in: Singapore

Test No. 13005

1500 mW/650 mW, 2 s/28 s, 5 min/h, 24 h/day

Test starting date: 2011-03-23

Battery	1,3 V (pulses)	1,2 V (pulses)	1,05 V (pulses)	1,0 V (pulses)	0,9 V (pulses)	0,8 V (pulses)
1	16	36	65	76	89	107
2	19	44	69	86	108	127
3	18	39	76	87	107	126
4	19	45	76	88	115	128
5	15	36	64	68	98	117
6	24	46	67	78	98	108
7	24	45	68	86	106	117
8	25	47	77	88	108	127
9	17	38	66	77	95	107
Average	20	42	70	82	103	118
Std. Dev.	3,7	4,5	5,1	7,1	8,1	9,1
Max. value	25	47	77	88	115	128
Min. value	15	36	64	68	89	107