Product Quick Search

Enter Energizer Product Number

(You must click 'GO' to activate)

OR...Select Product Group

Select Group and Click

Contents

Technical Information

Battery Engineering Guide

Datasheets | Application Manuals | Contacts | Product Safety Datasheets

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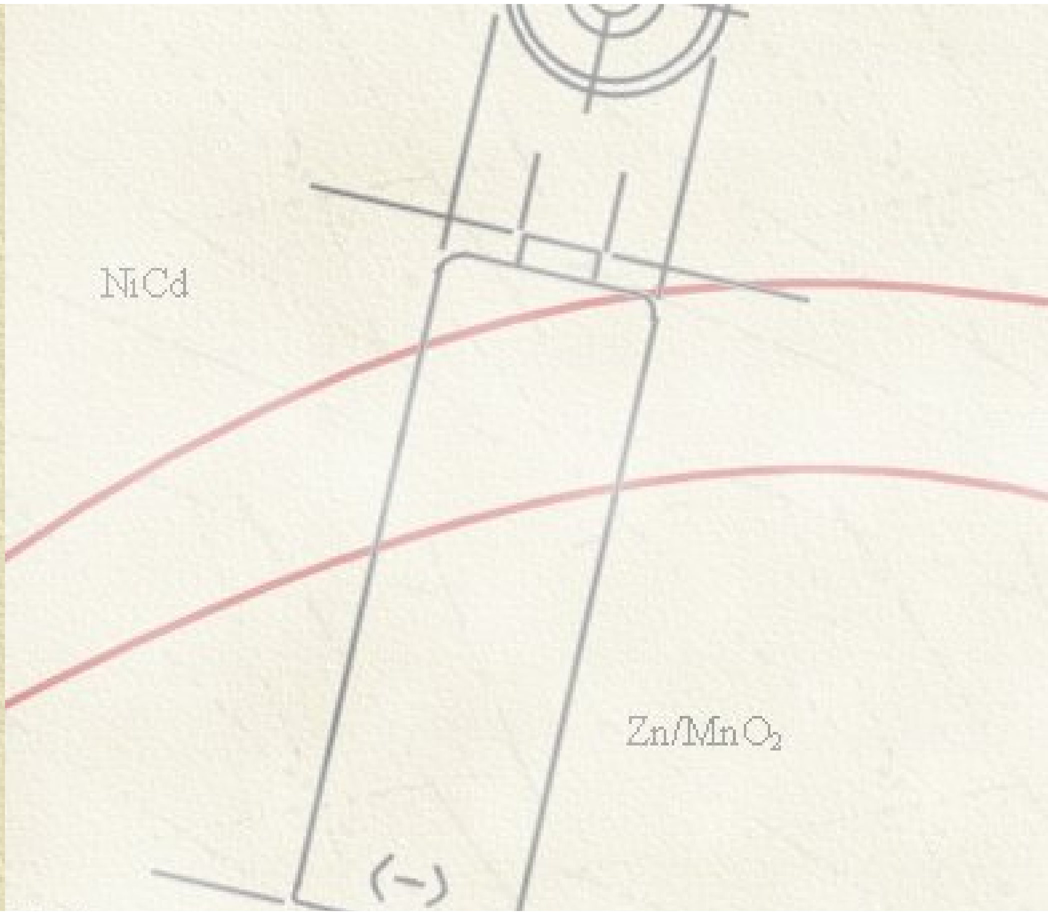
Technical Marketing

Revised: March 29, 2002

- Home
- Battery Information
- Cross Reference
- Product Safety Info
- Battery Disposal
- Glossary
- Comments
- Energizer Contacts
- References

- Energizer North America
- Energizer Europe



Contents

Contents

- **Energizer North America**
- **Energizer Europe**

Index of Active Battery Types

Click on a battery number to be taken to a characteristics summary table.

Battery Number	Chemical System
1209	Carbon Zinc
1212	Carbon Zinc
1215	Carbon Zinc
1222	Carbon Zinc
1235	Carbon Zinc
1250	Carbon Zinc
186	Alkaline Manganese Dioxide Zinc (Miniature)
189	Alkaline Manganese Dioxide Zinc (Miniature)
191	Alkaline Manganese Dioxide Zinc (Miniature)
192	Alkaline Manganese Dioxide Zinc (Miniature)
193	Alkaline Manganese Dioxide Zinc (Miniature)
206	Carbon Zinc
246	Carbon Zinc
266	Carbon Zinc
276	Carbon Zinc
2L76	Lithium Manganese Dioxide (Li/MnO_2)
3-0316	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-0316i	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-0316inn	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-0411	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-0411i	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-312	Alkaline Manganese Dioxide Zinc (Cylindrical)

3-312I	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-315	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-315i	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-315inn	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-315iwc	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-315wc	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-335	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-335i	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-335inn	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-335wc	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-350	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-350i	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-350inn	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-350iwc	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-350wc	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-361	Alkaline Manganese Dioxide Zinc (Cylindrical)
3-361i	Alkaline Manganese Dioxide Zinc (Cylindrical)
301	Silver Oxide Zinc
303	Silver Oxide Zinc
309	Silver Oxide Zinc
315	Silver Oxide Zinc
317	Silver Oxide Zinc
319	Silver Oxide Zinc
321	Silver Oxide Zinc
329	Silver Oxide Zinc
333	Silver Oxide Zinc
335	Silver Oxide Zinc
337	Silver Oxide Zinc

339	Silver Oxide Zinc
341	Silver Oxide Zinc
344	Silver Oxide Zinc
346	Silver Oxide Zinc
350	Silver Oxide Zinc
357	Silver Oxide Zinc
361	Silver Oxide Zinc
362	Silver Oxide Zinc
364	Silver Oxide Zinc
365	Silver Oxide Zinc
366	Silver Oxide Zinc
370	Silver Oxide Zinc
371	Silver Oxide Zinc
373	Silver Oxide Zinc
376	Silver Oxide Zinc
377	Silver Oxide Zinc
379	Silver Oxide Zinc
381	Silver Oxide Zinc
384	Silver Oxide Zinc
386	Silver Oxide Zinc
387S	Silver Oxide Zinc
389	Silver Oxide Zinc
390	Silver Oxide Zinc
391	Silver Oxide Zinc
392	Silver Oxide Zinc
393	Silver Oxide Zinc
394	Silver Oxide Zinc

395	Silver Oxide Zinc
396	Silver Oxide Zinc
397	Silver Oxide Zinc
399	Silver Oxide Zinc
411	Carbon Zinc
412	Carbon Zinc
413	Carbon Zinc
415	Carbon Zinc
416	Carbon Zinc
455	Carbon Zinc
467	Carbon Zinc
489	Carbon Zinc
493	Carbon Zinc
497	Carbon Zinc
504	Carbon Zinc
505	Carbon Zinc
510S	Carbon Zinc
521	Alkaline Manganese Dioxide Zinc (Cylindrical)
522	Alkaline Manganese Dioxide Zinc (Cylindrical)
528	Alkaline Manganese Dioxide Zinc (Cylindrical)
529	Alkaline Manganese Dioxide Zinc (Cylindrical)
539	Alkaline Manganese Dioxide Zinc (Cylindrical)
711	Carbon Zinc
732	Carbon Zinc
763	Carbon Zinc
A23	Alkaline Manganese Dioxide Zinc (Miniature)
A27	Alkaline Manganese Dioxide Zinc (Miniature)
A522	Alkaline Manganese Dioxide Zinc (Cylindrical)

A544	Alkaline Manganese Dioxide Zinc (Miniature)
A76	Alkaline Manganese Dioxide Zinc (Miniature)
A91	Alkaline Manganese Dioxide Zinc (Cylindrical)
A92	Alkaline Manganese Dioxide Zinc (Cylindrical)
A93	Alkaline Manganese Dioxide Zinc (Cylindrical)
A95	Alkaline Manganese Dioxide Zinc (Cylindrical)
AC312	Alkaline Zinc Air
AC13	Alkaline Zinc Air
AC146X	Alkaline Zinc Air
AC10/230	Alkaline Zinc Air
AC5	Alkaline Zinc Air
AC675	Alkaline Zinc Air
ACP5036	Alkaline
ACP5136	Alkaline
ACP7160	Alkaline Manganese Dioxide Zinc (Cylindrical)
CCM5060	Nickel Metal Hydride (NiMh)
CCM5260	Nickel Metal Hydride (NiMh)
CM1060H	Nickel Metal Hydride (NiMh)
CM1360	Nickel Cadmium (NiCd)
CM2560	Nickel Cadmium (NiCd)
CM6136	Nickel Metal Hydride (NiMh)
CV3010	Sealed Lead Acid
CV3012	Sealed Lead Acid
CV3112	Sealed Lead Acid
CP3036	Lithium Ion
CP3136	Lithium Ion
CP3336	Lithium Ion
CP5136	Nickel Metal Hydride (NiMh)

CP5648	Nickel Metal Hydride (NiMh)
CP5748	Nickel Metal Hydride (NiMh)
CP8049	Nickel Metal Hydride (NiMh)
CP8248	Nickel Metal Hydride (NiMh)
CP8648	Nickel Metal Hydride (NiMh)
CPV5136	Nickel Metal Hydride (NiMh)
CR1025	Lithium Manganese Dioxide (Li/MnO_2)
CR1216	Lithium Manganese Dioxde (Li/MnO_2)
CR1220	Lithium Manganese Dioxde (Li/MnO_2)
CR1225	Lithium Manganese Dioxde (Li/MnO_2)
CR1616	Lithium Manganese Dioxde (Li/MnO_2)
CR1620	Lithium Manganese Dioxde (Li/MnO_2)
CR1632	Lithium Manganese Dioxde (Li/MnO_2)
CR2012	Lithium Manganese Dioxde (Li/MnO_2)
CR2016	Lithium Manganese Dioxde (Li/MnO_2)
CR2025	Lithium Manganese Dioxde (Li/MnO_2)
CR2032	Lithium Manganese Dioxde (Li/MnO_2)
CR2320	Lithium Manganese Dioxde (Li/MnO_2)
CR2430	Lithium Manganese Dioxde (Li/MnO_2)
CR2450	Lithium Manganese Dioxde (Li/MnO_2)
CRV3	Lithium Manganese Dioxide (Li/MnO_2)
CXL-1000	Litium Ion
E11A	Alkaline Manganese Dioxide Zinc (Miniature)
E625G	Alkaline Manganese Dioxide Zinc (Miniature)
E90	Alkaline Manganese Dioxide Zinc (Cylindrical)
E91	Alkaline Manganese Dioxide Zinc (Cylindrical)
E92	Alkaline Manganese Dioxide Zinc (Cylindrical)
E93	Alkaline Manganese Dioxide Zinc (Cylindrical)

E95	Alkaline Manganese Dioxide Zinc (Cylindrical)
E96	Alkaline Manganese Dioxide Zinc (Cylindrical)
EDL4A	Alkaline Manganese Dioxide Zinc (Cylindrical)
EDL4AS	Alkaline Manganese Dioxide Zinc (Cylindrical)
EDL6A	Alkaline Manganese Dioxide Zinc (Cylindrical)
EL123AP	Lithium Manganese Dioxide (Li/MnO_2)
EL1CR2	Lithium Manganese Dioxide (Li/MnO_2)
EL223AP	Lithium Manganese Dioxide (Li/MnO_2)
EL2CR5	Lithium Manganese Dioxide (Li/MnO_2)
EN22	Alkaline Manganese Dioxide Zinc (Cylindrical)
EN529	Alkaline Manganese Dioxide Zinc (Cylindrical)
EN539	Alkaline Manganese Dioxide Zinc (Cylindrical)
EN6	Alkaline Manganese Dioxide Zinc (Cylindrical)
EN640A	Alkaline Manganese Dioxide Zinc (Miniature)
EN715	Alkaline Manganese Dioxide Zinc (Cylindrical)
EN90	Alkaline Manganese Dioxide Zinc (Cylindrical)
EN91	Alkaline Manganese Dioxide Zinc (Cylindrical)
EN92	Alkaline Manganese Dioxide Zinc (Cylindrical)
EN93	Alkaline Manganese Dioxide Zinc (Cylindrical)
EN95	Alkaline Manganese Dioxide Zinc (Cylindrical)
EPX76	Silver Oxide Zinc
ER-C510	Lithium Ion
ER-C580	Lithium Ion
ER-C630	Lithium Ion
ERC5160	Nickel Metal Hydride (NiMh)
ERC520	Lithium Ion
ERC525	Lithium Ion
ERC530	Lithium Ion
ERC545	Lithium Ion

ERC560	Lithium Ion
ERC570	Nickel Metal Hydride (NiMh)
ERC580	Lithium Ion
ERC590	Lithium Ion
ERC600	Lithium Ion
ERC610	Lithium Ion
ERC620	Lithium Ion
ERC630	Lithium Ion
ERC640	Lithium Ion
ERC650	Lithium Ion
ERC660	Lithium Ion
ERC670	Nickel Metal Hydride (NiMh)
ERC680	Lithium Ion
ERC700	Lithium Ion
ERD100	Lithium Ion
ERD110	Nickel Metal Hydride (NiMh)
ERD200	Lithium Ion
ERD300	Lithium Ion
ERP107	Nickel Metal Hydride (NiMh)
ERP110	Nickel Metal Hydride (NiMh)
ERP240	Nickel Metal Hydride (NiMh)
ERP268	Nickel Metal Hydride (NiMh)
ERP275	Nickel Cadmium (NiCd)
ERP290	Nickel Metal Hydride (NiMh)
ERP450	Nickel Metal Hydride (NiMh)
ERP506	Nickel Metal Hydride (NiMh)
ERP509	Nickel Metal Hydride (NiMh)
ERP730	Nickel Metal Hydride (NiMh)
ERP9116	Nickel Cadmium (NiCd)
ERW120	Lithium Ion
ERW210	Lithium Ion
ERW220	Lithium Ion

ERW230	Lithium Ion
ERW240	Lithium Ion
ERW305	Lithium Ion
ERW310	Lithium Ion
ERW320	Lithium Ion
ERW400	Lithium Ion
ERW500	Lithium Ion
ERW510	Lithium Ion
ERW520	Lithium Ion
ERW530	Lithium Ion
ERW600	Lithium Ion
ERW610	Lithium Ion
ERW700	Lithium Ion
ERW720	Lithium Ion
ERW800	Lithium Ion
EV115	Carbon Zinc
EV122	Carbon Zinc
EV131	Carbon Zinc
EV135	Carbon Zinc
EV150	Carbon Zinc
HS14196	Carbon Zinc
L522	Lithium Manganese Dioxide (Li/MnO_2)
L544	Lithium Manganese Dioxide (Li/MnO_2)
L91	Lithium Iron Disulfide (L91)
NH12	Nickel Metal Hydride (NiMh)
NH15	Nickel Metal Hydride (NiMh)
NH22	Nickel Metal Hydride (NiMh)
NH35	Nickel Metal Hydride (NiMh)
NH50	Nickel Metal Hydride (NiMh)
P2312	Nickel Metal Hydride (NiMh)
P2322M	Nickel Metal Hydride (NiMh)

P2331	Nickel Cadmium (NiCd)
P3201	Nickel Cadmium (NiCd)
P3301	Nickel Cadmium (NiCd)
P3302	Nickel Cadmium (NiCd)
P3303	Nickel Cadmium (NiCd)
P3306	Nickel Cadmium (NiCd)
P3391	Nickel Cadmium (NiCd)
P5256	Lead Acid
P7300	Nickel Cadmium (NiCd)
P7301	Nickel Cadmium (NiCd)
P7302	Nickel Cadmium (NiCd)
P7310	Nickel Cadmium (NiCd)
P7320	Nickel Cadmium (NiCd)
P7330	Nickel Cadmium (NiCd)
P7340	Nickel Cadmium (NiCd)
P7350	Nickel Cadmium (NiCd)
P7360	Nickel Cadmium (NiCd)
P7400	Nickel Cadmium (NiCd)
P7501	Nickel Cadmium (NiCd)
P8400	Nickel Metal Hydride (NiMh)
X522	Alkaline Manganese Dioxide Zinc (Cylindrical)
X91	Alkaline Manganese Dioxide Zinc (Cylindrical)
X92	Alkaline Manganese Dioxide Zinc (Cylindrical)
X93	Alkaline Manganese Dioxide Zinc (Cylindrical)
X95	Alkaline Manganese Dioxide Zinc (Cylindrical)

Index of Discontinued Battery Types

**** Suggested replacement specifications may differ from discontinued type. Please refer to datasheets for exact details. All dimensions are in millimeters.***

Name	Voltage	Chemistry	ANSI/ NEDA	IEC	Weight (g.)	Diameter (max.)	Height (max mm)	Length (max mm)	Width (max mm)	Suggested Replacement
164	1.4	Mercuric Oxide	N / A	N / A	0.36	6.80	2.15	N / A	N / A	364 1.55V
201	1.5	Silver Oxide	N / A	N / A	1.5	11.6	3.3	N / A	N / A	No Replacement
216	9.0	Carbon Zinc	1604	6F22	36	N / A	48.5	26.4	17.5	1222
226	9.0	Carbon Zinc	1600	6F24	45	25.4	49.2	N / A	N / A	No Replacement
228	12	Carbon Zinc	N / A	N / A	65.2	25.4	61.9	N / A	N / A	Eight No.E96 in series.
311	1.55	Silver Oxide	N / A	SR910SW	0.32	9.5	1.05	N / A	N / A	No Replacement
313	1.35	Mercuric Oxide	1152M	MR44	2.60	11.6	5.35	N / A	N / A	357 1.55V
314	1.55	Silver Oxide	N / A	SR716W	0.35	7.9	1.65	N / A	N / A	315
323	1.35	Mercuric Oxide	1156M	MR48	.1.40	7.90	5.35	N / A	N / A	309 1.55V
325	1.35	Mercuric Oxide	1155M	MR41	0.9	7.90	3.65	N / A	N / A	384 1.55V
333CZ	4.5	Carbon Zinc	N / A	N / A	25.5	16.81	49.91	N / A	N / A	Three No.EN1A in series.
343	1.35	Mercuric Oxide	1154M	MR42	1.70	11.6	3.50	N / A	N / A	344 1.55V
354	1.35	Mercuric Oxide	1153M	MR43	2.0	11.6	4.15	N / A	N / A	301 1.55V
355	1.5	Silver Oxide	N / A	N / A	3.69	15.5	4.85	N / A	N / A	No Replacement
387	1.4	Mercuric Oxide	1151M	MR42	1.40	11.6	3.60	N / A	N / A	387S 1.55V
388	1.4	Mercuric Oxide	1157M	N / A	1.10	8.85	3.30	N / A	N / A	No Replacement
417	15	Carbon Zinc	N / A	N / A	51	N / A	39.7	33.3	24.6	Two No. 411 in parallel

420	22.5	Carbon Zinc	N / A	N / A	70.9	N / A	55.6	33.3	24.6	No Replacement
457	67.5	Carbon Zinc	203	45F30	227	N / A	63.5	71.4	35.4	467 94.1 Ht.
460	45	Carbon Zinc	N / A	N / A	150	N / A	61.1	48.0	34.9	455
477	63	Carbon Zinc	N / A	N / A	244	N / A	138	48.8	27.0	467 67.5V, 95Ht. 71 L., 35 W.
479	90	Carbon Zinc	N / A	N / A	340	N / A	190	48.8	27.0	Two No.455 in series.
482	45	Carbon Zinc	N / A	N / A	851	N / A	139	91.3	46.8	Three No.455 in parallel. Snap terminals.
484	45	Carbon Zinc	N / A	N / A	1.42 kg	N / A	135	100	64.3	Five No.455 in parallel.
487	22.5, 45	Carbon Zinc	N / A	N / A	1.87 kg	N / A	184	130	52.4	Two No.763 in series.
490	90	Carbon Zinc	204	60F40	460	N / A	94.1	94.5	34.9	Two No. 455 in series
491	240	Carbon Zinc	N / A	N / A	369	N / A	114	65.9	33.3	Eight No. 413 in series. Or Five No. 415 in series
496	450	Carbon Zinc	N / A	N / A	2.38 kg	N / A	127	172	76.2	No Replacement
509	6	Carbon Zinc	908	4R25	593	N / A	112	66.7	66.7	1209
510F	6.0	Carbon Zinc	N / A	N / A	567	N / A	112	66.7	66.7	510S w/ Screw Terminals
520	6.0	Alk-Manganese Dioxide	N / A	N / A	1.13 kg	N / A	67.5	141	118	521 125.4 Ht 136.5L, 73W.
523	4.5	Alk-Manganese Dioxide	N / A	N / A	33.2	16.8	49.9	N / A	N / A	EN133A
531	4.5	Alk-Manganese Dioxide	N / A	N / A	35.4	16.8	58.2	N / A	N / A	EN133A Flat Contact
532	3.0	Alk-Manganese Dioxide	N / A	N / A	22.7	16.9	42.4	N / A	N / A	EN132A 33.4Ht Flat contact
537	6.0	Alk-Manganese Dioxide	N / A	N / A	14.2	13.0	25.2	N / A	N / A	No Replacement
538	4.5	Alk-Manganese Dioxide	N / A	N / A	12.8	N / A	11.4	40.6	17.0	No Replacement
544	6.2	Silver Oxide	1406SOP	4SR44	14.2	12.95	25.15	N / A	N / A	A544 150mAh L544 190mAh
560	7.5	Alk-Manganese Dioxide	N / A	N / A	709	N / A	182	67.5	38.9	No Replacement

561	15	Alk-Manganese Dioxide	N / A	N / A	2.72 kg	N / A	149	211	71.4	No Replacement
563	4.5	Alk-Manganese Dioxide	N / A	N / A	425	34.5	182	N / A	N / A	No Replacement
564	13.5	Alk-Manganese Dioxide	N / A	N / A	2.5 kg	N / A	149	211	71.4	No Replacement
565	6.0	Alk-Manganese Dioxide	N / A	N / A	1.13 kg	N / A	136	70.6	70.6	No Replacement
646	69	Carbon Zinc	N / A	N / A	1.45 kg	N / A	205	65.1	54.0	Three No. 467 in parallel. 67.5V
703	4.5	Carbon Zinc	N / A	N / A	142	N / A	63.5	61.9	21.4	Three No. 1215 in series
706	6.0	Carbon Zinc	902	4R25-4	2.68 kg	N / A	163.5	219.1	71.4	Four No. 510S in parallel
714	4.5	Carbon Zinc	N / A	N / A	383	N / A	95.3	101	34.1	No Replacement
715	7.5	Carbon Zinc	903	5R25-4	3.46 kg	N / A	163.5	184.2	103.2	EN715 97 Ht.
716	9.0	Carbon Zinc	904	6R25-4	3.8 kg	N / A	163.5	217.9	103.2	No Replacement
717	7.5	Carbon Zinc	N / A	N / A	227	N / A	77.0	54.8	49.2	No Replacement
724	6.0	Carbon Zinc	N / A	N / A	70.9	N / A	59.5	31.0	31.0	Four No.1215 in parallel
731	6.0	Carbon Zinc	918	4R25-2	1.25 kg	N / A	125.4	136.5	73	EV131
735	1.5	Carbon Zinc	900	R25-4	653	N / A	109.5	66.7	66.7	EN6 Cylindrical with 66.7 Dia., 170 Ht
736	4.5	Carbon Zinc	3	3R25	455	N / A	101.6	100.1	33.3	No Replacement
738	22.5, 45	Carbon Zinc	N / A	N / A	539	N / A	105.0	76.2	58.7	HS14196
742	1.5	Carbon Zinc	N / A	N / A	624	N / A	97.6	66.7	66.7	EN6 Cylindrical with 66.7 Dia., 170 Ht
744	6.0	Carbon Zinc	N / A	N / A	624	N / A	97.6	66.7	66.7	510S
750	3.0	Carbon Zinc	N / A	N / A	56.7	N / A	54.0	31.0	15.9	Two No. 1215 in series
762S	22.5, 45	Carbon Zinc	N / A	N / A	1.25 kg	N / A	138.0	104	65.1	No Replacement
773	1.5,3.0, 4.5,6.0 7.5	Carbon Zinc	N / A	N / A	255	N / A	76.2	99.2	21.4	No Replacement

778	3.0,4.5 6.0,9.0, 10.5,16.5, 22.5	Carbon Zinc	N / A	N / A	567	N / A	79.4	102	61.9	No Replacement
781	4.5	Carbon Zinc	N / A	N / A	142	N / A	76.2	61.9	21.4	No Replacement
812	1.5	Carbon Zinc	AAA	N / A	8.5	10.3	44.5	N / A	N / A	1212
815	1.5	Carbon Zinc	AA	N / A	17	14.3	50.0	N / A	N / A	1215
835	1.5	Carbon Zinc	C	N / A	39.7	26.2	49.2	N / A	N / A	1235
850	1.5	Carbon Zinc	D	N / A	93.6	34.1	61.1	N / A	N / A	1250
904	1.5	Carbon Zinc	N	N / A	6.24	11.3	30.0	N / A	N / A	E90
912	1.5	Carbon Zinc	AAA	N / A	8.5	10.3	44.5	N / A	N / A	1212
915	1.5	Carbon Zinc	AA	N / A	14.8	14.3	50.0	N / A	N / A	1215
935	1.5	Carbon Zinc	14F	R14	41	26.2	50	N / A	N / A	1235
950	1.5	Carbon Zinc	13F	R20	81	34.2	61.5	N / A	N / A	1250
1015	1.5	Carbon Zinc	15F	R6	15	14.5	50.5	N / A	N / A	1215
1035	1.5	Carbon Zinc	C	N / A	39.7	26.2	49.2	N / A	N / A	1235
1050	1.5	Carbon Zinc	D	N / A	85.1	34.1	61.1	N / A	N / A	1250
1150	1.5	Carbon Zinc	D	N / A	85.1	34.1	61.1	N / A	N / A	1250
1231	6.0	Carbon Zinc	918D	4R25-2	1.27 kg	N / A	125.4	136.5	73	521
1461	6.0	Carbon Zinc	907	4R25-4	2.68 kg	N / A	163.5	219.1	71.4	Four No. 510S in parallel
1463	12	Carbon Zinc	922	8R25-2	2.66 kg	N / A	163.5	219.1	71.4	Two No. 732 in parallel
1562	7.5	Carbon Zinc	N / A	N / A	5.1 kg	N / A	183	199	126.0	EN715
1862	12	Carbon Zinc	935	8R25-5	6.3 kg	N / A	171.5	214.3	133.4	No Replacement
2356N	9.0	Carbon Zinc	1612	6F22-9	357	N / A	158.8	55.5	29.4	Nine No. 216 in parallel

2709N	9.0	Carbon Zinc	N / A	N / A	70.9	N / A	119	35.7	18.7	No Replacement
2744N	6.0	Carbon Zinc	920	4R25	632	N / A	97.6	66.7	66.7	510S see attached for details
2745N	6.0	Carbon Zinc	N / A	N / A	652	N / A	112	66.7	66.7	1209
2746N	6.0	Carbon Zinc	N / A	N / A	652	N / A	110	66.7	66.7	510S
2780N	12	Carbon Zinc	N / A	N / A	1.36 kg	N / A	112.7	136	72.2	No Replacement
AC41E	1.4	Zinc Air	7001Z	PR43	1.4	11.6	4.20	N / A	N / A	301 1.55V
CC1096	9.6	NiCd for Camcorder	N / A	N / A	327	N / A	112.4	68.1	35.3	No Replacement
CCM1460	6.0	NiCd for Camcorder	N / A	N / A	148.6	N / A	89.7	46.0	19.1	No Replacement
CCM2460	6.0	NiCd for Camcorder	N / A	N / A	303.1	N / A	89.3	46.1	41.5	No Replacement
CCM4060A	7.2	NiCd for Camcorder	N / A	N / A	303.1	N / A	89.3	46.1	41.5	No Replacement
CCM4060M	6.0	NiMH for Camcorder	N / A	N / A	332	N / A	89.2	46.5	46.2	No Replacement
CDC100	N / A	NiCd / NiMH Charger	N / A	N / A	73.7	N / A	115.6	59.9	25.4	No Replacement
CH12	1.2	Nickel Cadmium	10024	KR11 / 45	9.5	10.5	44.5	N / A	N / A	NH12
CH15	1.2	Nickel Cadmuim	10015	KR15 / 51	22.7	14.5	50.5	N / A	N / A	NH15
CH2AA	N / A	NiCd Charger	N / A	N / A	368.3	N / A	100.1	47.5	31.5	No Replacement
CH22	7.2	Nickel Cadmuim	11604	6KR61	43	N / A	48.5	26.5	16.9	NH22
CH35	1.2	Nickel Cadmuim	10014	KR27 / 50	54	26.2	50.0	N / A	N / A	NH35
CH4	1.2	Nickel Cadmuim	10013HC	KR35 / 62	135	34.2	61.5	N / A	N / A	No Replacement
CH50	1.2	Nickel Cadmuim	10013	KR35 / 82	67	34.2	61.5	N / A	N / A	NH50
CM1060	6.0	NiCd for Camcorder	N / A	N / A	157	N / A	90.0	47.1	22.8	No Replacement
CM1560	6.0	NiCd for Camcorder	N / A	N / A	170	N / A	89.3	45.9	18.7	No Replacement

CM2360	6.0	NiCd for Camcorder	N / A	N / A	303.1	N / A	89.4	49.8	43.4	No Replacement
CM4160	6.0	NiCd for Camcorder	N / A	N / A	300	N / A	89.2	48.5	36.6	No Replacement
CM6036	3.6	NiMH for Camcorder	N / A	N / A	181.7	N / A	71.4	55.6	19.8	No Replacement
CM9072	7.2	Lithium Ion for Camcorder	N / A	N / A	97.8	N / A	70.6	38.4	20.3	No Replacement
CM9172	7.2	Lithium Ion for Camcorder	N / A	N / A	98.0	N / A	70.1	38.2	20.2	No Replacement
CP2360	6.0	NiMH for Cellular	N / A	N / A	N / A	N / A	101.6	56.1	20.1	No Replacement
CP3336	3.6	Lithium Ion	N / A	N / A	47.5	N / A	52.8	46.0	14.0	N / A
CP3536	3.6	Lithium Ion for Camcorder	N / A	N / A	120	N / A	49.8	35.6	13.2	No Replacement
CP3736	3.6	Lithium Ion for Camcorder	N / A	N / A	N / A	N / A	60.2	49.3	12.2	No Replacement
CP5036	3.6	NiMH for Cellular	N / A	N / A	50	N / A	42.2	52.1	13.5	No Replacement
CP5160	6.0	NiMH for Cellular	N / A	N / A	119	N / A	120.4	58.9	11.4	No Replacement
CP5648	4.8	NiMH for Cellular	N / A	N / A	68	N / A	111.1	45.8	12.7	No Replacement
CP5960	6.0	NiMH for Cellular	N / A	N / A	108.9	N / A	131.8	53.9	8.1	No Replacement
CP6072	7.2	Lithium Ion for Cellular	N / A	N / A	110	N / A	129.8	49.5	22.1	No Replacement
CP6172	7.2	Lithium Ion for Cellular	N / A	N / A	110	N / A	128.5	48.0	21.6	No Replacement
CP7049	4.8	NiCd for Cellular	N / A	N / A	120.2	N / A	119.6	52.6	17.1	No Replacement
CP7072	7.2	NiCd for Cellular	N / A	N / A	170	N / A	167.1	38.1	18.2	No Replacement
CP7148	4.8	NiCd for Cellular	N / A	N / A	113.2	N / A	78.0	45.7	17.0	No Replacement
CP7149	4.8	NiCd for Cellular	N / A	N / A	94.3	N / A	81.3	56.9	17.5	No Replacement
CP7160	6.0	NiCd for Cellular	N / A	N / A	151.1	N / A	120.9	58.9	19.3	No Replacement
CP7172	7.2	NiCd for Cellular	N / A	N / A	162	N / A	166.6	38.9	18.3	No Replacement

CP7248	4.8	NiCd for Cellular	N / A	N / A	93	N / A	101.6	29.3	15.1	No Replacement
CP7261	6.0	NiCd for Cellular	N / A	N / A	135	N / A	94.5	54.9	17.8	No Replacement
CP7348	4.8	NiCd for Cellular	N / A	N / A	117	N / A	113.0	55.1	17.5	No Replacement
CP7548	4.8	NiCd for Cellular	N / A	N / A	107	N / A	110.8	35.3	17.3	No Replacement
CP7661	6.0	NiCd for Cellular	N / A	N / A	142	N / A	111.3	46.0	21.6	No Replacement
CP7960	6.0	NiCd for Cellular	N / A	N / A	146	N / A	133.4	54.1	17.0	No Replacement
CP8049	4.8	NiMH for Cellular	N / A	N / A	N / A	N / A	119.9	52.6	15.8	No Replacement
CP8136	3.6	NiMH for Cellular	N / A	N / A	89	N / A	75.6	46.9	15.5	No Replacement
CP8160	6.0	NiMH for Cellular	N / A	N / A	167.3	N / A	120.9	59.0	19.3	No Replacement
CP8172	6.0	NiMH for Cellular	N / A	N / A	195.2	N / A	166.6	38.9	18.3	No Replacement
CP8248	4.8	NiMH for Cellular	N / A	N / A	133	N / A	101.6	19.3	15.1	No Replacement
CP8661	6.0	NiMH for Cellular	N / A	N / A	154	N / A	110.7	45.4	18.5	No Replacement
CP8748	4.8	NiMH for CellularNiMH for Cellular	N / A	N / A	121.0	N / A	120.7	35.1	20.3	No Replacement
CP8948	4.8	NiMH for Cellular	N / A	N / A	123.0	N / A	116.7	39.2	17.7	No Replacement
CP8960	6.0	NiMH for Cellular	N / A	N / A	156.0	N / A	133.4	54.1	17.0	No Replacement
CP9061	6.0	NiCd for Cellular	N / A	N / A	158	N / A	108.7	54.6	21.8	No Replacement
CP9148	4.8	NiCd for Cellular	N / A	N / A	128.3	N / A	77.5	50.5	19.3	No Replacement
CP9161	6.0	NiCd for Cellular	N / A	N / A	156.2	N / A	99.8	54.1	20.8	No Replacement
CP9360	6.0	NiCd for Cellular	N / A	N / A	168	N / A	99.3	56.1	23.1	CP2360
CS3336	8.6	N / A	N / A	N / A	N / A	N / A	N / A	N / A	N / A	No Replacement
CS5036	4.0	N / A	N / A	N / A	91	N / A	N / A	N / A	N / A	No Replacement

CS5460	8.6	N / A	N / A	N / A	N / A	N / A	N / A	N / A	N / A	No Replacement
CS7048	6.5	N / A	N / A	N / A	131.3	N / A	N / A	N / A	N / A	No Replacement
CS7072	7.2	N / A	N / A	N / A	113.3	N / A	N / A	N / A	N / A	No Replacement
CS7148	4.8	N / A	N / A	N / A	111.3	N / A	N / A	N / A	N / A	No Replacement
CS7149	N / A	N / A	N / A	N / A	93.1	N / A	N / A	N / A	N / A	No Replacement
CS7160	6.0	N / A	N / A	N / A	141.6	N / A	N / A	N / A	N / A	No Replacement
CS7248	6.5	N / A	N / A	N / A	N / A	N / A	N / A	N / A	N / A	No Replacement
CS7261	6.5	N / A	N / A	N / A	123	N / A	N / A	N / A	N / A	No Replacement
CS7348	6.5	N / A	N / A	N / A	122.3	N / A	N / A	N / A	N / A	No Replacement
CS7448	N / A	N / A	N / A	N / A	98	N / A	N / A	N / A	N / A	No Replacement
CS7548	6.5	N / A	N / A	N / A	85.2	N / A	N / A	N / A	N / A	No Replacement
CS7661	6.5	N / A	N / A	N / A	102.4	N / A	N / A	N / A	N / A	No Replacement
CS8136	8.6	N / A	N / A	N / A	88	N / A	N / A	N / A	N / A	No Replacement
CS8648	8.0	N / A	N / A	N / A	N / A	N / A	N / A	N / A	N / A	No Replacement
CS9061	6.0	N / A	N / A	N / A	115	N / A	N / A	N / A	N / A	No Replacement
CS9148	5.2	N / A	N / A	N / A	91.5	N / A	N / A	N / A	N / A	No Replacement
CS9161	6.5	N / A	N / A	N / A	89.4	N / A	N / A	N / A	N / A	N / A
CV2012	12	NiCd for Camcorder	N / A	N / A	595.5	N / A	155.7	72.2	50.1	No Replacement
CV2096	9.6	NiCd for Camcorder	N / A	N / A	459.9	N / A	112.4	66.5	49.7	No Replacement
CV3010S	10	Lead Acid for Camcorder	N / A	N / A	567	N / A	120.6	73.4	35.4	No Replacement
CV3012	12	Lead Acid for Camcorder	N / A	N / A	681.8	N / A	182.12	61.7	23.9	No Replacement

CV3060	6.0	Lead Acid for Camcorder	N / A	N / A	387.3	N / A	146.4	58.0	34.7	No Replacement
CV3112	12	Lead Acid for Camcorder	N / A	N / A	500	N / A	144.5	66.0	23.9	No Replacement
CV3212	12	Lead Acid for Camcorder	N / A	N / A	818.2	N / A	151.6	65.0	26.9	No Replacement
E1	1.4	Mercuric Oxide	1100M	NR50	13.5	16.0	16.5	N / A	N / A	No Replacement
E1N	1.4	Mercuric Oxide	1109M	MR50	14.3	16.0	16.5	N / A	N / A	No Replacement
E3	1.4	Mercuric Oxide	M60	MR17	28.4	25.0	16.8	N / A	N / A	No Replacement
E4	1.4	Mercuric Oxide	1112M	MR19	41.0	30.4	16.7	N / A	N / A	No Replacement
E9	1.4	Mercuric Oxide	15M	NR6	31	14.2	50.5	N / A	N / A	E91 or L91
E12	1.4	Mercuric Oxide	M70	N / A	40.0	15.9	49.9	N / A	N / A	E91 1.5V 14.5 D, 50.5Ht.
E12N	1.4	Mercuric Oxide	M70	N / A	40.0	15.9	49.9	N / A	N / A	E91 1.5V 14.5 D, 50.5Ht.
E13E	1.4	Mercuric Oxide	1180M	NR48	1.1	7.8	5.35	N / A	N / A	AC13
E41E	1.4	Mercuric Oxide	1182M	NR43	2.0	11.6	4.20	N / A	N / A	No Replacement
E42	1.4	Mercuric Oxide	N / A	N / A	167	30.4	60.7	N / A	N / A	E95 1.5V 34.2 D, 61.5 Ht.
E42N	1.4	Mercuric Oxide	N / A	N / A	167	30.4	60.7	N / A	N / A	E95 1.5V 34.2 D, 61.5 Ht.
E89	1.5	Mercuric Oxide	1182M	NR43	2.0	11.6	4.20	N / A	N / A	No Replacement
E115	7.0	Mercuric Oxide	N / A	N / A	20.0	17.0	33.5	N / A	N / A	No Replacement
E115N	6.8	Mercuric Oxide	N / A	N / A	20.0	16.8	33.5	N / A	N / A	No Replacement
E126	8.4	Mercuric Oxide	N / A	N / A	46.8	18.5	50.8	N / A	N / A	206
E132	2.8	Mercuric Oxide	1200M	2NR50	28	17.0	33.4	N / A	N / A	No Replacement
E132N	2.7	Mercuric Oxide	1203M	2MR50	30	17.0	33.4	N / A	N / A	No Replacement
E133	4.2	Mercuric Oxide	1306M	3NR50	42	17.0	50.0	N / A	N / A	No Replacement

E133N	4.1	Mercuric Oxide	1314M	3MR50	45	17.0	50.0	N / A	N / A	No Replacement
E134	5.6	Mercuric Oxide	1408M	4NR50	56	17.0	66.2	N / A	N / A	No Replacement
E134N	5.4	Mercuric Oxide	1409M	4MR50	60	17.0	66.2	N / A	N / A	No Replacement
E135	7.0	Mercuric Oxide	N / A	N / A	67.2	16.8	82.4	N / A	N / A	No Replacement
E135N	6.8	Mercuric Oxide	1505M	5MR50	74	17.0	83.0	N / A	N / A	No Replacement
E136	8.4	Mercuric Oxide	1615M	6NR50	85	17.0	100	N / A	N / A	No Replacement
E137	9.8	Mercuric Oxide	N / A	N / A	94.7	16.8	115	N / A	N / A	No Replacement
E137N	9.8	Mercuric Oxide	N / A	N / A	94.7	16.8	115	N / A	N / A	No Replacement
E146X	8.4	Mercuric Oxide	1604M	N / A	55	N / A	44.5	26.2	16.8	AC146X
E152	2.8	Mercuric Oxide	N / A	N / A	11.3	12.3	28.9	N / A	N / A	No Replacement
E163	4.2	Mercuric Oxide	N / A	N / A	25.5	16.8	33.2	N / A	N / A	No Replacement
E164	5.6	Mercuric Oxide	1404M	4NR52	36	17.0	44.5	N / A	N / A	No Replacement
E164N	5.6	Mercuric Oxide	N / A	N / A	36	17.0	44.5	N / A	N / A	No Replacement
E165	7.0	Mercuric Oxide	1500M	5NR52	45	17.0	56.0	N / A	N / A	No Replacement
E169	12.6	Mercuric Oxide	N / A	N / A	76.5	16.8	102	N / A	N / A	No Replacement
E177	9.8	Mercuric Oxide	1606M	7NR44	24.1	13.9	48.5	N / A	N / A	No Replacement
E233	4.2	Mercuric Oxide	N / A	N / A	89.3	26.0	50.6	N / A	N / A	No Replacement
E233N	4.2	Mercuric Oxide	N / A	N / A	89.3	26.0	50.6	N / A	N / A	No Replacement
E235N	6.8	Mercuric Oxide	N / A	N / A	149	25.8	84.1	N / A	N / A	No Replacement
E236N	8.1	Mercuric Oxide	N / A	N / A	179	25.8	99.2	N / A	N / A	No Replacement
E286	8.4	Mercuric Oxide	N / A	N / A	77	25.4	49.3	N / A	N / A	No Replacement

E289	12.6	Mercuric Oxide	N / A	N / A	102	25.4	61.1	N / A	N / A	No Replacement
E312E	1.4	Mercuric Oxide	1178M	NR41	0.9	7.9	3.60	N / A	N / A	AC312
E340E	1.5	Carbon Zinc	N	N / A	6.24	11.3	29.9	N / A	N / A	E90
E400	1.4	Mercuric Oxide	M10	MR08	1.42	11.6	3.43	N / A	N / A	No Replacement
E400N	1.4	Mercuric Oxide	1116M	MR42	1.40	11.6	3.60	N / A	N / A	387S 1.55V
E401E	1.4	Mercuric Oxide	910M	NR1	13	12.0	29.0	N / A	N / A	E90 1.5V
E401N	1.4	Mercuric Oxide	1117M	MR1	13	12.0	29.0	N / A	N / A	E90 1.5V
E450	1.4	Mercuric Oxide	N / A	N / A	51	11.6	14.5	N / A	N / A	No Replacement
E502	1.4	Mercuric Oxide	N / A	N / A	29	13.7	49.5	N / A	N / A	No Replacement
E601	1.4	Mercuric Oxide	N / A	N / A	22	15.9	29.0	N / A	N / A	No Replacement
E625	1.4	Mercuric Oxide	1123M	MR9	4.20	15.6	6.05	N / A	N / A	E625G 1.5V
E630	1.4	Mercuric Oxide	M20	MR9	4.8	15.6	6.05	N / A	N / A	No Replacement
E640	1.4	Mercuric Oxide	1105M	NR52	7.94	15.9	11.2	N / A	N / A	No Replacement
E640N	1.4	Mercuric Oxide	N / A	M30	7.94	15.9	11.2	N / A	N / A	No Replacement
E675E	1.4	Mercuric Oxide	1127M	NR44	2.60	11.6	5.35	N / A	N / A	AC675
E302157	1.4	Mercuric Oxide	N / A	N / A	383	N / A	108	63.5	34.9	No Replacement
E302250	9.5	Mercuric Oxide	N / A	N / A	28.4	17.5	48.4	N / A	N / A	No Replacement
E302358	10.8	Mercuric Oxide	N / A	N / A	36.9	19.1	55.6	N / A	N / A	No Replacement
E302435	6.8	Mercuric Oxide	N / A	N / A	21.3	17.5	38.1	N / A	N / A	No Replacement
E302462	97.2	Mercuric Oxide	N / A	N / A	907	N / A	163	71.4	38.9	No Replacement
E302465	47.3	Mercuric Oxide	N / A	N / A	482	54	95.3	N / A	N / A	No Replacement

E302478	9.8	Mercuric Oxide	N / A	N / A	255	31.8	92.1	N / A	N / A	No Replacement
E302642	7.0	Mercuric Oxide	N / A	N / A	170	32.5	66.7	N / A	N / A	No Replacement
E302651	1.4	Mercuric Oxide	N / A	N / A	174	33.3	61.9	N / A	N / A	No Replacement
E302702	2.7	Mercuric Oxide	N / A	N / A	56.7	28.6	41.3	N / A	N / A	No Replacement
E302904	5.4	Mercuric Oxide	N / A	N / A	170	34.1	74.6	N / A	N / A	No Replacement
E302905	6.8	Mercuric Oxide	N / A	N / A	255	34.1	90.5	N / A	N / A	No Replacement
E302908	10.8	Mercuric Oxide	N / A	N / A	340	34.1	141	N / A	N / A	No Replacement
E303145	8.4	Mercuric Oxide	N / A	N / A	265	N / A	113	55.6	21.4	No Replacement
E303236	4.2	Mercuric Oxide	N / A	N / A	36.3	16.0	49.0	N / A	N / A	No Replacement
E303314	16.8	Mercuric Oxide	N / A	N / A	363	N / A	33.5	72.4	71.4	No Replacement
E303394	11.2	Mercuric Oxide	N / A	N / A	397	N / A	57.9	63.5	44.5	No Replacement
E303496	4.2	Mercuric Oxide	N / A	N / A	24.7	16.6	33.8	N / A	N / A	No Replacement
E303996	8.4	Mercuric Oxide	1619M	N / A	55	N / A	44.7	26.5	17.00	No Replacement
EA6	1.5	Carbon Zinc	6	N / A	964	66.7	168	N / A	N / A	EN6
EA6F	1.5	Carbon Zinc	6	N / A	964	66.7	172	N / A	N / A	EN6 w / Screw Terminal
EA6FT	1.5	Carbon Zinc	6	N / A	964	66.7	172	N / A	N / A	EN6 w / Screw Terminal
EA6ST	1.5	Carbon Zinc	6	N / A	964	66.7	168	N / A	N / A	EN6 w / Screw Terminal
EN1A	1.5	Button	1100A	LR50	8.3	15.8	16.5	N / A	N / A	No Replacement
EN132A	3.0	Button Stack	1200A	2LR50	18	17.1	33.4	N / A	N / A	No Replacement
EN133A	4.5	Button Stack	1306A	3LR50	27	17.1	49.9	N / A	N / A	No Replacement
EN134A	6.0	Button Stack	1409A	4LR50	36	17.1	66.5	N / A	N / A	No Replacement

EN135A	7.5	Button Stack	1505A	5LR50	45	17.1	83.2	N / A	N / A	No Replacement
EN136A	9.0	Button Stack	1615A	6LR50	54	17.1	99.8	N / A	N / A	No Replacement
EN164A	6.0	Button Stack	1404A	4LR52	25.5	17.1	44.9	N / A	N / A	No Replacement
EN165A	7.5	Button Stack	1500A	5LR52	31.5	17.1	56.2	N / A	N / A	No Replacement
EN175A	7.5	Button Stack	1501A	5LR44	9.5	12.7	27.7	N / A	N / A	No Replacement
EN177A	10.5	Button Stack	1606A	7LR44	14	13.0	47.2	N / A	N / A	No Replacement
EN640A	1.5	Button	1126A	LR52	6	15.8	11.1	N / A	N / A	No Replacement
EP175	7.0	Mercuric Oxide	1501MD	5NR44	11.9	12.6	27.8	N / A	N / A	No Replacement
EP401E	1.4	Mercuric Oxide	1118M	NR1	13	12.0	29.3	N / A	N / A	E90 1.5V
EP675E	1.4	Mercuric Oxide	1127MD	NR44	2.60	11.6	5.35	N / A	N / A	AC675
EPX1	1.4	Mercuric Oxide	1110MP	MR50	14.3	16.0	16.5	N / A	N / A	No Replacement
EPX4	5.6	Mercuric Oxide	N / A	N / A	34	16.8	49.9	N / A	N / A	No Replacement
EPX13	1.4	Mercuric Oxide	1114MP	MR9	4.20	15.6	6.05	N / A	N / A	E625G 1.5V
EPX14	2.7	Mercuric Oxide	1201MP	2MR9	8.50	16.9	15.4	N / A	N / A	No Replacement
EPX23	5.6	Mercuric Oxide	1407MP	4NR43	7.80	15.25	20.5	N / A	N / A	No Replacement
EPX25	4.1	Mercuric Oxide	1311MP	3MR9	15.0	16.8	21.5	N / A	N / A	No Replacement
EPX27	5.6	Mercuric Oxide	1413MP	4NR43	7.70	12.7	20.5	N / A	N / A	No Replacement
EPX29	4.1	Manganese Dioxide	N / A	N / A	7.25	12.1	7.25	N / A	N / A	No Replacement
EPX30	3.0	Manganese Dioxide	N / A	N / A	14.3	24.4	12.3	N / A	N / A	No Replacement
EPX625	1.4	Mercuric Oxide	1124MP	MR9	4.20	15.6	6.05	N / A	N / A	E625G 1.5V
EPX640	1.4	Mercuric Oxide	1126MP	MR52	8.50	16.0	11.2	N / A	N / A	No Replacement

EPX675	1.4	Mercuric Oxide	1128MP	MR44	2.60	11.6	5.35	N / A	N / A	EPX76 1.5V
EPX825	5.6	Manganese Dioxide	N / A	N / A	6.93	22.9	5.79	N / A	N / A	No Replacement
EV6	1.5	Carbon Zinc	905	R40	710	66.8	170.7	N / A	N / A	EN6
EV9	1.4	Mercuric Oxide	15M	NR6	31	14.2	50.5	N / A	N / A	E91 or L91
EV10S	6.0	Carbon Zinc	915	4R25	632	N / A	109.5	66.7	66.7	510S
EV15	1.5	Carbon Zinc	15C	LR6	15	14.5	50.5	N / A	N / A	EV115
EV22	9.0	Carbon Zinc	1604D	6F22	36	N / A	48.5	26.4	17.5	EV122
EV31	6.0	Carbon Zinc	918	4R25-2	1.25 kg	N / A	125.4	136.5	73	EV131
EV35	1.5	Carbon Zinc	14C	R14	41	26.2	49.8	N / A	N / A	EV135
EV50	1.5	Carbon Zinc	13C	R20	81	34.2	61.5	N / A	N / A	EV150
EV90	6.0	Carbon Zinc	908C	4R25	625	N / A	112	66	N / A	EV190
EV90HP	6.0	Carbon Zinc	908C	4R25	625	N / A	112	66	N / A	EV190
FCC2	N / A	Nickel Cadmium	N / A	N / A	368.3	N / A	100.1	47.5	31.5	N / A
HS6	1.5	Carbon Zinc	6	N / A	907	66.7	168	N / A	N / A	EN6
HS10S	6.0	Carbon Zinc	N / A	N / A	652	N / A	110	66.7	66.7	510S
HS15	1.5	Carbon Zinc	AA	N / A	14.8	14.3	50.0	N / A	N / A	EV15
HS31	6.0	Carbon Zinc	N / A	N / A	1.47 kg	N / A	125	136.0	72.2	521
HS35	1.5	Carbon Zinc	C	N / A	41.0	26.2	49.2	N / A	N / A	EV35
HS50	1.5	Carbon Zinc	D	N / A	85.1	34.1	61.1	N / A	N / A	EV50
HS90	6.0	Carbon Zinc	N / A	N / A	638	N / A	112	66.7	66.7	EV90
HS95	1.5	Alk-Manganese Dioxide	N / A	N / A	128	34.1	61.8	N / A	N / A	EN95

HS150	1.5	Carbon Zinc	D	N / A	85.1	34.1	63.5	N / A	N / A	1250
HS6571	22.5	Carbon Zinc	N / A	N / A	451	N / A	77.75	88.9	53.2	763 w / Screw Terminal
IF6	1.5	Carbon Zinc	6	N / A	907	66.7	172	N / A	N / A	EN6 w / Screw Terminal
IS6	1.5	Carbon Zinc	6	N / A	907	66.7	168	N / A	N / A	EN6
IS6T	1.5	Carbon Zinc	6	N / A	964	66.7	168	N / A	N / A	EN6 w / Screw Terminal
P2321M	3.6	NiMH for Cordless	N / A	N / A	N / A	N / A	N / A	N / A	N / A	No Replacement
P2322	3.6	Nickel Cadmium	N / A	N / A	N / A	N / A	N / A	N / A	N / A	P2322M NiMH
P2326M	3.6	NiMH for Cordless	N / A	N / A	N / A	N / A	N / A	N / A	N / A	No Replacement
P7307	3.6	NiCd for Cordless	N / A	N / A	N / A	N / A	N / A	N / A	N / A	No Replacement
P7507	6.0	NiCd for Cordless	N / A	N / A	N / A	N / A	N / A	N / A	N / A	No Replacement
QCC4	N / A	Nickel Cadmium	N / A	N / A	658	N / A	2.5	7.1	4.5	No Replacement
S13E	1.6	Silver Oxide	1181SO	SR48	1.13	7.90	5.4	N / A	N / A	AC13
S312E	1.6	Silver Oxide	1179SO	SR41	0.57	7.90	5.4	N / A	N / A	AC312
S41E	1.6	Silver Oxide	1183SO	SR43	1.70	11.6	4.2	N / A	N / A	386
S76E	1.6	Silver Oxide	1184SO	SR44	2.27	11.6	5.4	N / A	N / A	AC675
T35	1.5	Carbon Zinc	C	N / A	39.7	26.2	49.2	N / A	N / A	1235
T50	1.5	Carbon Zinc	D	N / A	93.6	34.1	61.1	N / A	N / A	1250
W353	1.5	Carbon Zinc	N / A	N / A	388	N / A	105.6	65.9	34.9	EN6 Note: EN6 has Terminal Screws

Contents

- **Cross Reference**
- **Product Safety Info**
- **Battery Disposal**
- **Glossary**
- **Comments**
- **Energizer Contacts**
- **References**

- **Energizer North America**
- **Energizer Europe**

Contents

- **Product Safety Info**
- **Battery Disposal**
- **Glossary**
- **Comments**
- **Energizer Contacts**
- **References**

- **Energizer North America**
- **Energizer Europe**

Contents

[Discontinued Index]

- **Home**
- **Battery Information**
- **Cross Reference**
- **Product Safety Info**
- **Battery Disposal**
- **Glossary**
- **Comments**
- **Energizer Contacts**
- **References**

- **Energizer North America**
- **Energizer Europe**

Contents

Flashlights

Consumer

Industrial

Bulbs

Active Index

Discontinued Index

Home
Battery Information
Cross Reference
Product Safety Info
Battery Disposal
Glossary
Comments
Energizer Contacts
References

Energizer North America
Energizer Europe

Contents

Battery Type

- **Glossary**
- **Comments**
- **Energizer Contacts**
- **References**

- **Energizer North America**
- **Energizer Europe**

Contents

- **Home**
- **Battery Information**
- **Cross Reference**
- **Product Safety Info**
- **Battery Disposal**
- **Glossary**
- **Comments**
- **Energizer Contacts**
- **References**

- **Energizer North America**
- **Energizer Europe**

Contents

Energizer Contacts

References

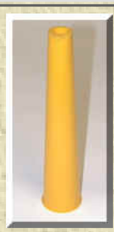
- **Moltech (Rechargeable OEM)**
- **Energizer North America**
- **Energizer Europe**

Industrial Flashlights

HOME

Model Number	Picture	Type	Qty/ Battery Size	Bulb Type	Weight (g)*	Length (mm)	Width (mm)	Height (mm)
459		Heavy Duty Industrial	6 Volt Lantern	KPR113	475	200	129	136
208IND		Heavy Duty Industrial	6 Volt Lantern	PR13	293	203	124.6	123.3
231IND		Special Industrial	6 Volt Lantern	KPR113 & 407	326	239	123	125
1151		Heavy Duty Industrial	2 / AA	PR4	48	153	35	N.A.
1251		Heavy Duty Industrial	2 / D	PR2	113	203.2	60.5	N.A.
1259		Heavy Duty Safety Industrial (UL / MSHA approved)	2 / D	PR2 or PR6	113	203.2	60.5	N.A.
1351		Heavy Duty Industrial	3 / D	PR3	142	262.4	60.5	N.A.

1359		Heavy Duty Safety Industrial (UL/MSHA approved)	3/D	PR7	142	262.4	60.5	N.A.
3251R		Value Industrial	2/D	PR2	61	185.2	52.3	N.A.
3251WH		Medical Industrial	2/D	PR2	61	185.2	52.3	N.A.
4212WH		Medical Industrial	2/AAAA	222	21	66.5	14.0	22.3
4250IND		Heavy Duty Industrial	2/D	KPR102	148	214	74	N.A.
5109IND		Value Industrial	6 Volt Lantern	PR13	220	183	99	117
6212WH		Medical Industrial	2/AAA	243	9	139.2	12.4	N.A.
9101IND		Special Industrial	6 Volt Lantern	4546	525	215	120	N.A.
E250Y		Value Industrial	2/D	KPR102	88	187.0	60.5	N.A.

E251Y		Value Industrial	2 / D	KPR102	139	187.0	60.5	N.A.
IN220		Heavy Duty Industrial	2 / AA	KPR104	57	166	44.8	N.A.
IN253		Heavy Duty Industrial	2 / D	KPR102	107	195.6	62.2	N.A.
IN420		Special Industrial	4 / AA	KPR113	283	104	57	46
IN450		Industrial	4 / D	KPR113	359	206.5	139.7	N.A.
INDWANDR		Heavy Duty Industrial	N.A.	N.A.	34	208	45	N.A.
INDWANDY		Heavy Duty Industrial	N.A.	N.A.	34	208	45	N.A.
R215IND		Heavy Duty Industrial	2 / AA	KPR104	94	166	45	N.A.

*** Weight without batteries**

Contents

Battery Type

- Primary
- Rechargeables

Battery Index Guide

- Active Batteries
- Discontinued Batteries

Battery Chemistry

- Alkaline
- Carbon Zinc
- Lithium Cylindrical
- Lithium Miniature
- Manganese Dioxide - Miniature
- Nickel Metal Hydride
- Silver Oxide - Miniature
- Zinc Air

Flashlights

- Consumer
- Industrial
- Bulbs
  - Standard
  - Krypton
  - Halogen
  - Fluorescent
  - High Intensity
  - Halogen Xenon
  - Industrial
- Active Index
- Discontinued Index

- **Home**
- **Battery Information**
- **Cross Reference**
- **Product Safety Info**
- **Battery Disposal**
- **Glossary**

Comments
Energizer Contacts
References

Moltech (Rechargeable OEM)
Energizer North America
Energizer Europe

Active Flashlight Index

HOME

If a flashlight model is not found here, please check the "Discontinued Flashlight Index", call us at 1-800-383-7323 or email us at energizer@speedymail.com .

Model Number	Picture	Type	Qty/ Battery Size	Bulb Type	Weight (g)*	Length (mm)	Width (mm)	Height (mm)
459		Heavy Duty Industrial	6 Volt Lantern	KPR113	475	200	129	136
208IND		Heavy Duty Industrial	6 Volt Lantern	PR13	293	203	124.6	123.3
231IND		Special Industrial	6 Volt Lantern	KPR113 & 407	326	239	123	125
1151		Heavy Duty Industrial	2 / AA	PR4	48	153	35	N.A.
1251		Heavy Duty Industrial	2 / D	PR2	113	203.2	60.5	N.A.
1259		Heavy Duty Safety Industrial (UL / MSHA approved)	2 / D	PR2 or PR6	113	203.2	60.5	N.A.

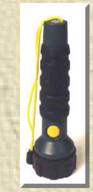
1351		Heavy Duty Industrial	3 / D	PR3	142	262.4	60.5	N.A.
1359		Heavy Duty Safety Industrial (UL / MSHA approved)	3 / D	PR7	142	262.4	60.5	N.A.
2251		Home	2 / D	HPR52	142	214.4	51.8	N.A.
3251		Eveready	2 / D	PR2	61	185.2	52.3	N.A.
3251R		Value Industrial	2 / D	PR2	61	185.2	52.3	N.A.
3251WH		Medical Industrial	2 / D	PR2	61	185.2	52.3	N.A.
4212		Eveready	2 / AAAA	222	21	66.5	14.0	22.3
4212WH		Medical Industrial	2 / AAAA	222	21	66.5	14.0	22.3
4215		Novelty	2 / AA	PR4	37	97.1	42.7	26.0
4250IND		Heavy Duty Industrial	2 / D	KPR102	148	214	74	N.A.

4251		Eveready	2 / D	KPR102	99	192.0	60.7	N.A.
5100		Outdoor	6 Volt Lantern	425	190	182	115	N.A.
5109		Eveready	6 Volt Lantern	PR13	220	183	99	117
5109IND		Value Industrial	6 Volt Lantern	PR13	220	183	99	117
5215		Novelty	2 / AA	PR4	48	95.2	47.2	22.9
6212		Novelty	2 / AAA	243	9	139.2	12.4	N.A.
6212WH		Medical Industrial	2 / AAA	243	9	139.2	12.4	N.A.
8209		Outdoor	6 Volt Lantern	KPR113	448	218.4	91.4	117.1.
8215		Outdoor	4 / AA	PR35	142	176.5	76.6	N.A.
9101IND		Special Industrial	6 Volt Lantern	4546	525	215	120	N.A.
9450		Outdoor	4 / D	F6T5, KPR113, PR13	401	113.0	43.9	318.5

BAS24A		Novelty	2 / AAAA	243	37	99.34	21.55	39.89
CFL420		Premium	4 / AA	KPR802	69.4	149.96	55.88	N.A.
D410		Premium	4/AAA	TX15-2	107.3	177.8	37.2	N.A.
D420		Premium	4 / AA	TX15-2	231.0	245.0	55.0	N.A.
DB24A1		Novelty	2/AAAA	TI-2	15	75.3	11.6	19.7
E220		Home	2/AA	KPR104	46	147.8	41.6	N.A.
E250		Home	2/D	KPR102	88	187.0	60.5	N.A.
E250Y		Value Industrial	2/D	KPR102	88	187.0	60.5	N.A.
E251		Home	2/D	KPR102	139	187.0	60.5	N.A.

E251Y		Value Industrial	2 / D	KPR102	139	187.0	60.5	N.A.
ERG2C1		Home	2 / C	KPR102	63	210.3	60.3	N.A.
F101		Outdoor	6 Volt Lantern	KPR113	452	180	135	148
F220		Outdoor	2 / AA	243	38	151	29.8	N.A.
F420		Outdoor	4 / AA	KPR113	283	103.5	N.A.	45.8
FAB4DCM		Outdoor	4 / D	KPR113	771	263.0	N.A	150.0
FL450		Outdoor	4 / D	F4T5	525.4	194	104	73.7
FN450		Work	4 / D	KPR113	424	198.1	124.4	137.1
GLO4AA1		Home	4 / AA	KPR102	107	134.0	89.5	62.6

IN215		Work	2 / AA	KPR104	48	152.9	35.3	N.A.
IN220		Heavy Duty Industrial	2 / AA	KPR104	57	166	44.8	N.A.
IN251		Work	2 / D	KPR102	110	203.2	60.5	N.A.
IN253		Heavy Duty Industrial	2 / D	KPR102	107	195.6	62.2	N.A.
IN351		Work	3 / D	KPR103	142	262.4	60.5	N.A.
IN420		Special Industrial	4 / AA	KPR113	283	104	57	46
IN450		Industrial	4 / D	KPR113	359	206.5	139.7	N.A.
INDWANDR		Heavy Duty Industrial	N.A.	N.A.	34	208	45	N.A.
INDWANDY		Heavy Duty Industrial	N.A.	N.A.	34	208	45	N.A.

K220		Work	2 / AA	KPR104	113	187.5	60.8	N.A.
K221		Outdoor	2 / AA	KPR104	113	187.5	60.8	N.A.
K250		Work	2 / D	KPR102	276.8	242.8	91.4	N.A.
K251		Outdoor	2 / D	KPR102	276.8	242.8	91.4	N.A.
KCBG		Novelty	Button	LED	12	41	29	14
KCCL		Novelty	Button	LED	14	78.8	47.6	7.3
KCDL		Novelty	2 / AAAA	243	36.7	91.2	N.A	38.8.
KCL2BU1		Novelty	2 / CR2032 Li Coin	LED	16.5	63.4	20.0	42.0
KCWL		Novelty	Button	LED	21.2	83.1	21.1	N.A.
LED4AA1		Outdoor	4 / AA	LED	62.6	91.2	24.8	59.6

LTCR		Novelty	2 / AAA	LED	28	84	44	25
LTEB		Novelty	2 / AAAA	222	75	55.4	61.2	99.3
LTPT		Novelty	2 / AAAA	222	50	106.2	23.6	46.5
R215		Work	2 / AA	KPR104	94	166.1	44.6	N.A.
R215IND		Heavy Duty Industrial	2 / AA	KPR104	94	166	45	N.A.
R250		Work	2 / D	KPR102	148	214.0	74.3	N.A.
R450		Work	4 / D	KPR113	556	224	78.5	107.2.
RC210		Home	2 / Button	243	55	79.4	50.7	15.9
RC220		Home	2 / Button	243	124	112.8	63.5	25.3
RC250		Home	2 / Button	PR4	160	188.1	71.4	N.A
SL240		Novelty	2 / AAAA	243	21.2	69.3	17.5	28

SP220		Outdoor	2 / AA	KPR104	101	159.5	53.5	N.A.
TW420		Outdoor	4 / AA	KPR102	226	152.4	85.5	N.A.
TW450		Outdoor	4 / D	KPR102	502.8	176.8	122.6	N.A.
V109		Work	6 Volt Lantern	KPR113	297	203.7	74.2	125.3.
V115		Work	1 / AA	112	19	80.4	27.7	N.A.
V215		Work	2 / AA	KPR104	60	153.7	42.4	N.A.
V220		Novelty	2 / AA	PR4	113	86.8	38.9	113.4
V250		Work	2 / D	KPR102	160	196.0	72.4	N.A.
VAL2DL1		Work	KPR102	160	196.0	72.4	NA	
WP220		Outdoor	2 / AA	KPR104	56.5	166.4	44.8	N.A.

WP250		Outdoor	2 / D	KPR102	107.3	195.6	62.2	N.A.
X112		Home	1 / AAA	T1-1	16	81.5	20.1	N.A.
X215		Home	2 / AA	T1-2	43	154.7	27.7	N.A.

* **Weight without batteries**
** **Weight with batteries**

*Discontinued Flashlight Index**

HOME

*** This table is provided for reference only.**
The types listed are no longer manufactured, but may still be offered for sale in some locations.
For a listing of current models, click on the Active Flashlight Index or call 1-800-383-7323 or email us at energizer@speedymail.com .

**** Weight without batteries**

Model Number	Picture	Qty/ Battery Size	Bulb Type	Weight (g)**	Length (mm)	Width (mm)	Height (mm)
108		6 Volt Lantern	PR13	227	212	97	130
209		6 Volt Lantern	HPR50	266	185	109	120
330		2 / D	PR2	113	200	53	N.A.
330Y		2 / D	PR2	113	200	53	N.A.
331		2 / D	PR2	128	200	53	N.A.
331Y		2 / D	PR2	128	200	53	N.A.
1251BK		2 / D	PR2	113	203.2	60.5	N.A.
2253		2 / D	HPR52	142	214	52	N.A.
3233		2 / C	PR4	68	160	50	N.A.

3253		2 / D	PR4	79	185	52	N.A.
3415		4 / AA	PR13	79	119	62	N.A.
3452		6 Volt Lantern	PR13	105	N.A.	82	N.A.
4220		2 / AA	PR4	42	95	47	N.A.
4453		4 / D	KPR113 407(Flasher)	347	203	104	N.A.
5154		6 Volt Lantern	KPR113	340	245	125	125
5251		2 / D	PR2	57	185	52	N.A.
7369		6 Volt Lantern	4546	396	215	124	140
8115		2 / AA	243	96	112	45	41
8415		4 / AA	KPR113	128	120	65	N.A.
B170		CR2025	LED	-	9.9	5.6	4.2
BKC1		2 / AA, CR2025 2 / C	KPR104	-	10.8	10.8	14.0
D620		6 / AA	T2-3	277	288	57.7	N.A.
D820		8 / AA	T2-4	322	337.8	57.7	N.A.

E100		6 Volt Lantern	KPR113	210	22	15	8
E252		2 / D	KPR102	-	18.6	7.8	11.4
E350		3 / D	KPR103	168	265.7	77	N.A.
E420		4 / AA	KPR113	80	78	44	123
EM290		2 / Button	PR4	33	109.8	68.8	31.5
EM420		4 / AA	PR13	458	138 179 Ext.	68.8	N.A.
F100		6 Volt Lantern	KPR113	1070	197	127	136
F215		2 / AA	PR2	113	121.0	56.7	39.2
F250		2 / D	KPR102	198	227	89	65
F415		4 / AA	F4T5	187	46.0	50.3	204.3
H100		6 Volt Lantern	HPR50	464	179	134	148

H250		2 / D	HPR52	186	236	84	N.A.
H350		3 / D	HPR53	203	300	83.3	N.A.
IN25T		2 / D	PR2	155	205	57	N.A.
KCDB		Button	LED	16	66	23	N.A.
KCSG		Button	LED	20	41.5	26	31
KCTW		Button	LED	16	50	27	N.A.
RC100		3 / Sub C	KPR103	487**	103.7	70.4	162.3
RC251		2 / AA	KPR102	217	190.0	70.0	55.0
RC290		2 / Button	PR4	175	188.1	71.0	N.A
T430		4 / C	1651	212	260.4	78.7	N.A.
V235		2 / C	KPR102	85	159	55	N.A.

X250		2 / D	KPR102	290	267	64	N.A.
X350		3 / D	KPR103	325	328	64	N.A.

Choose from the selection of battery types listed below to be taken to the page containing a list of all datasheets for that chemistry. To access an application manual, click on either the primary or rechargeable buttons located above.

- Alkaline
  - Energizer e2
  - Eveready
  - Consumer/OEM
  - Industrial
  - OEM Only
- Carbon Zinc (Zn/MnO_2)
  - Consumer/OEM
  - Industrial
- Lithium
  - Lithium
  - Lithium Miniature
- Miniature Manganese Dioxide(Zn/MnO_2)
- Nickel-Cadmium (NiCd)
- Nickel-Metal Hydride (Ni/MH)
- Silver Oxide (Zn/AG_2O)
- Zinc Air (Zn/O_2)

Battery Application Manuals:

Also Available:

Contacts

HOME

Product Safety Data Sheets

Phone: 1-800-383-7323
Tech Info Website @ "Product Safety Info"

Battery Ingestion Hotline:

National Poison Control Center: 1-202-625-3333

Energizer Offices

I. USA

Energizer Battery Company
533 Maryville University Drive
St. Louis, MO 63141
Telephone: 1-800-383-7323
Email: energizer@speedymail.com

II. Europe

- **Primary OEM (Non-Rechargeable Batteries)**

Energizer, UK
93 Burleigh Gardens
Southgate
London N14 5AQ, England
Phone: 44-181-882-8661 / 8681
FAX: 44-181-882-1938

- **Consumer (Primary & Rechargeable Batteries)**

Energizer
Ralston Energy Systems, SA
P.O. Box 230
1218 Le Grand Sacaonnex
Geneva, Switzerland
Phone: 41-22-9299-438

III. Asia

Primary (Consumer)

Eveready Battery Company
Asia Pacific, Inc.
16th Floor, New World Bldg.
24 Salisbury Road
Kowloon, Hong, Kong
Telephone: 852-2731-3300
Fax: 852-2739-7258

Primary (OEM)

Eveready Batteries Hong Kong Ltd.
Rm 1601-1605, 16/F., China Resources Building,
26 Harbour Road, Wan Chai, Hong Kong
Telephone: 852-2956-2333
Fax: 852-2956-2686

Technical Marketing

Revised: March 29, 2002

HOME

Product Safety Data Sheets

As a courtesy to our customers, we have prepared copyrighted Product Safety Data Sheets which will provide information on the different Eveready battery systems. As defined in OSHA Hazard Communication Standard, Section 1910.1200©, Eveready batteries are manufactured "articles", which do not result in exposure to a hazardous chemical under normal conditions of use. For this reason, Material Safety Data Sheets should not be required.

Click here to find PSDS by battery number.

- ***Product Safety Data Sheets in English***
  Alkaline Manganese Dioxide Zinc (Cylindrical)
  Alkaline Manganese Dioxide Zinc (Miniature)
  Alkaline Zinc-Air (Mercury)
  Alkaline Zinc-Air (No Mercury)
  Carbon Zinc
  Nickel Cadmium (NiCd)
  Nickel Metal Hydride (NiMH)
  Lead Acid
  Lithium Iron Disulfide (L91)
  Lithium Manganese Dioxide (Li/MnO2)
  Lithium Ion
  Mercuric Oxide-Zinc
  Silver Oxide-Zinc

- ***Product Safety Data Sheets in French***
  Alcalin au Bioxyde de Manganese Zinc (Cylindrique)
  Carbone Zinc
  Lithium-bioxyde de manganèse

- ***Product Safety Data Sheets in Spanish***
  Alcalino Manganese Dioxide Zinc (Cilíndrico)
  Zinc-Aire Alcalino (Mercurio)
  Zinc-Aire Alcalino (No Mercurio)
  Carbon Zinc

Note: This information is updated periodically. Please check back frequently to insure that you have the most up to date information.

Back to Application Manual Home Page

Cross Reference Tables Available:

HOME

Battery Disposal Statements

These documents are advisory in nature and are intended to provide battery disposal guidance based on current United States federal laws and regulations. The information and conclusions set forth herein are made in good faith and are believed to be accurate at the time of preparation. However, by United States law, waste disposal determinations are ultimately the responsibility of the generator

- **Alkaline Manganese Dioxide Zinc and Carbon Zinc**
- **Nickel Metal Hydride (NiMH)**
- **Lithium Manganese Dioxide (L522)**
- **Lithium Iron Disulfide (L91)**
- **Lithium Manganese Dioxide (Li/MnO2)**

Note: This information is updated periodically.
Please check back frequently to insure that you have the most up to date information.

Active Material	Specific chemically reactive material at the positive or negative electrode that takes part in the charge and discharge reactions.
Air Cell	Battery system which utilizes oxygen in combination with catalyzed carbon as the cathode and zinc as the anode to produce electricity.
Alkaline Battery	Primary battery which employs alkaline aqueous solution for its electrolyte.
Ampere-Hours	Product of current (amperes), multiplied by time (in hours) the circuit is closed (current flowing).
Anode	The negative electrode. The electrode at which an oxidation reaction (loss of electrons) occurs.
ANSI	American National Standards Institute sponsored by NEMA, National Electric Manufacturers Association and cover cell sizes, terminals and testing procedures.
Average Drain	The average current withdrawn from a cell or battery during discharge; usually approximated by calculating the current at 50% depth of discharge.
Battery	Technically, a battery consists of two or more series or parallel connected galvanic cells. Frequently, however, a single cell is called a battery.
Button Cell	See miniature battery
Capacity	Output capability over a period of time; expressed in ampere-hours.
Carbon Zinc	A generic term for primary dry batteries of the LeClanche or Zinc Chloride systems.
Cathode	The positive electrode. The electrode at which a reduction reaction (gain of electrons) occurs.
Cell	A primary galvanic unit which converts chemical energy directly into electric energy. Typically consists of two electrodes of dissimilar material isolated from one another electronically in a common ironically conductive electrolyte.
Cell Reversal	Reversing polarity of terminals of a cell or battery due to overdischarge.
Charge,State of	Condition in terms of the rated capacity remaining at a given point in time.
Charging	Process of supplying electrical energy for conversion to stored chemical energy.
Closed-circuit voltage (CCV)	Voltage as measured of a cell or battery under a specific discharge load and time interval.
Coin Cell	See miniature battery
Collector	Electronic connection between the battery electrode and the external circuit.
Constant Current	Charging or discharging method in which current does not change appreciably in magnitude regardless of battery voltage or temperature.
Constant Power	Power remains stable regardless of battery voltage. As battery voltage changes, the current is adjusted to maintain targeted power value. (See below for power definition.)
Constant Resistance	Commonly found in devices which maintain a constant resistance throughout the battery discharge. As the battery is drained, both voltage and current decline.
Continuous Test Regimen	Charge and/or discharge profile that is defined without rest periods.
Cutoff Voltage	Voltage at the end of useful discharge. Battery voltage below which the connected equipment will not operate or below which operation is not recommended.

Cycle	One sequence of activity. This can be a pulse or continuous drain.
Cylindrical Battery	A battery whose height is greater than its diameter. The term cylindrical is also used to describe batteries made up of cylindrical cells.
Deep Discharge	Discharge of the battery to below the specified voltage cutoff before the battery is replaced or recharged.
Depth of Discharge (DOD)	The percent of rated capacity to which a cell or battery is discharged.
Discharge	Withdrawal of electrical energy from a cell or battery, usually to operate connected equipment.
Discharge Rate	The current at which a cell or battery is discharged.
Drain	Withdrawal of current from a cell or battery.
Drain, Heavy	Generally, current that would discharge a battery within one day at room temperature.
Drain, Light	Generally, current that would discharge a battery after one month at room temperature.
Drain, Moderate	Current that would discharge a battery in approximately one week at room temperature.
Dry Battery	A battery in which the electrolyte is immobilized, being either in the form of a paste or gel or absorbed into the separator material.
Duty Cycle	The time duration and use frequency during which a battery is drained (i.e. 2 hours/day).
Electrode	Conducting body at which the electrochemical reaction occurs.
Electrolyte	May be solid or liquid. Usually an aqueous salt solution that permits ionic conduction between the positive and negative electrodes
Energy	Output capability; ampere-hour capacity times average closed-circuit discharge voltage, expressed as watt-hours.
Energy Density	Ratio of battery energy to weight or volume (watt-hours per kilogram or watt-hours per cubic centimeter).
Functional End Point (FEP)	Voltage below which battery-operated equipment will not function properly.
IEC	International ElectroChemical Commission. A worldwide organization for standardization in the electrical and electronic fields.
Impedance (Z)	The total opposition that a battery offers to the flow of alternating current. Impedance is a combination of resistance and reactance.
Initial Drain	Current that a cell or battery supplies when first placed on load. Also referred to as starting drain.
Internal Resistance (R_i)	Opposition to direct current flow within a battery, with the battery as source, causing a drop in closed-circuit voltage proportional to the current drain from the battery.
Intermittent Test Regimen	Charge and/or discharge profile that is defined with specified rest periods.
LeClanche	A Carbon Zinc battery with slightly acidic electrolyte consisting of ammonium chloride and zinc chloride in water.
Miniature Battery	A button or coin shaped battery whose diameter is greater than its height. The term "Miniature" is also used to describe batteries made up of miniature cells.
Open-Circuit Voltage (OCV)	The no load voltage of a cell or battery measured with a high resistance voltmeter.
Polarization	Electrical potential reduction of electrodes typically arising from prolonged or rapid discharge of the battery.

Primary	A cell or battery designed to deliver its rated capacity once and be discarded; not designed to be recharged.
Rated Capacity	The average capacity delivered by a cell or battery on a specified load and temperature to a voltage cutoff point, as designated by the manufacturer; usually an accelerated test approximating the cell or battery's capacity in typical use.
Rate Sensitivity	Typically refers to battery performance under various discharge loads with operating voltage being the defining characteristic
Rating Drain	The specified current withdrawn form a cell or battery to determine its rating capacity.
Rechargeable	Capable of being recharged; refers to secondary cells or batteries.
Secondary	A cell or battery designed to be recharged.
Self Discharge Rate	The rate at which a cell or battery loses its capacity when standing idle.
Service Maintenance	The percent of fresh rated capacity remaining after a specified period of time.
Shelf-Life	The amount of time a cell or battery will retain a specified percent of its rated capacity, typically under ambient storage conditions.
Silver Oxide	Battery containing cathode of silver oxide, anode of zinc and highly alkaline electrolyte consisting of NaOH or KOH.
Trickle Charge	A method of recharging in which a secondary battery is either continuously or intermittently connected to a constant current supply that maintains the battery in a fully or near full charged condition.
Zinc Air	See Air Cell
Zinc Chloride	A Carbon Zinc battery with a slightly acidic electrolyte consisting mainly of zinc chloride in water.

Back to Top of Page

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Energizer appreciates your feedback and would like to make this process as easy as possible. Please fill out the information below, and add any comments and/or questions you may have.

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Eveready Battery Company Inc.

Revised: May 16, 2001.

References

Energizer Distributor

Swess Hao Co. Ltd.
6F, 2, Alley 36, Lane 26, Juikung Road,
Neihu 114, Taipei, Taiwan
ROC
Phone: 886-2-87925699
Fax: 886-2-87924888
email: swesshao@ms31.hinet.net

Auto/Marine Batteries

Johnson Controls
507 E Michigan Street
P.O. Box 423
Milwaukee, WI 53201
Phone: 1-800-972-8040 ext. 135
http://www.johnsoncontrols.com
email: stephen.a.thomas@jci.com

OEM Rechargeable

Moltech Power Systems
(Formerly - Energizer Power Systems)
U.S. Highway 441 North
P.O. Box 147114
Gainesville, FL 32614-7114
Telephone: (386) 462-3911
Fax: (386) 462-4726
http://www.moltechpower.com

Bulbs

Bulb Direct
Phone: 800-772-5267
Fax: 800-257-0760
http://www.bulbdirect.com
Email: info@bulbdirect.com

Chicago Miniature Lamp

280-T Railroad Avenue
Hackensack, N.J. 07601
Phone: 1-888-236-1091
Fax: 201-489-6911
http://www.chml.com

GE Lighting
Customer Service Center
9100 Purdue Road, Suite 400
Indianapolis, IN 46268
Phone: 1-800-243-7313
Business Centers
Phone: 1-800-626-2004
Fax: 1-518-869-2828
http://www.ge.com

United Lamp Supply
215 So. 50th st.
Tacoma, Wa. 98408
Phone: 1-800-238-3776
Fax: 1-253-473-2352
http://www.unitedlamp.com

Connectors

Connector Corporation
4720 Yerder Road
Lisle, IL 60532-1653
Phone: (630) 969-3400
Fax: 630-969-3545

Battery Holders

Keystone Electronics Corp.
31-07 20th Road
Astoria, NY 11105-2017
Phone: 1-800-394-5778
Fax: 718/956-9040
http://www.keyelco.com
email: tr@keyelco.com

Memory Protection Devices, Inc.
200 Broadhollow Road, Suite 4
Farmingdale, NY 11735-4814 USA
Phone: (631) 249-0001
Fax: 631/249-0002

http://www.batteryholders.com
email: sales@batteryholders.com

Power Dynamics, Inc.
145 Algonquin Parkway
Whippany, NJ 07981
Phone: (973) 560-0019
Fax: 973/560-0076
http://www.powerdynamics.com
email: customerservice@powerdynamics.com

Reference Books

Handbook Of Batteries
Author: David Linden
Copyright: 1995
Publisher: McGraw-Hill, Inc.

Modern Battery Technology
Editor: Clive D. S. Tuck
Copyright: Ellis Horwood Limited, 1991
Publisher: Ellis Horwood Limited

Handbook of Chemistry and Physics
79th Edition
Editor: David R. Lide, Ph.D
Copyright: 1998
Publisher: CRC Press

General

Hydrogen Getters
GPT Inc.
P.O. Box 261
Manalanen, NJ 07726

NEMA (National Electrical Manufacturers Association)
1300-T N 17th Street
Suite 1847
Rosslyn, VA 22209
Phone: (703) 841-3200
Fax: 703/841-3300
www.NEMA.org

IEC (International Electrotechnical Commission)
3 Rue de Varembe
P.O. Box 131

1211 Geneva 20
Switzerland
Phone: 41-22-919-0211
Fax: 41-22-919-0300
www.IEC.ch

RBRC (Rechargeable Battery Recycling Corporation)
1000 Parkwood Circle
Suite 450
Atlanta, Georgia 30339
Phone: (678) 419-9990
Fax: (678) 419-9986
1-800-8-BATTERY
(1-800-228-8379)
www.rbrc.org

EPBA (European Portable Battery Association)
Avenue Marcel Thiry 200 B-1200
Brussels, Belgium
Phone: 32-2-774-96-02
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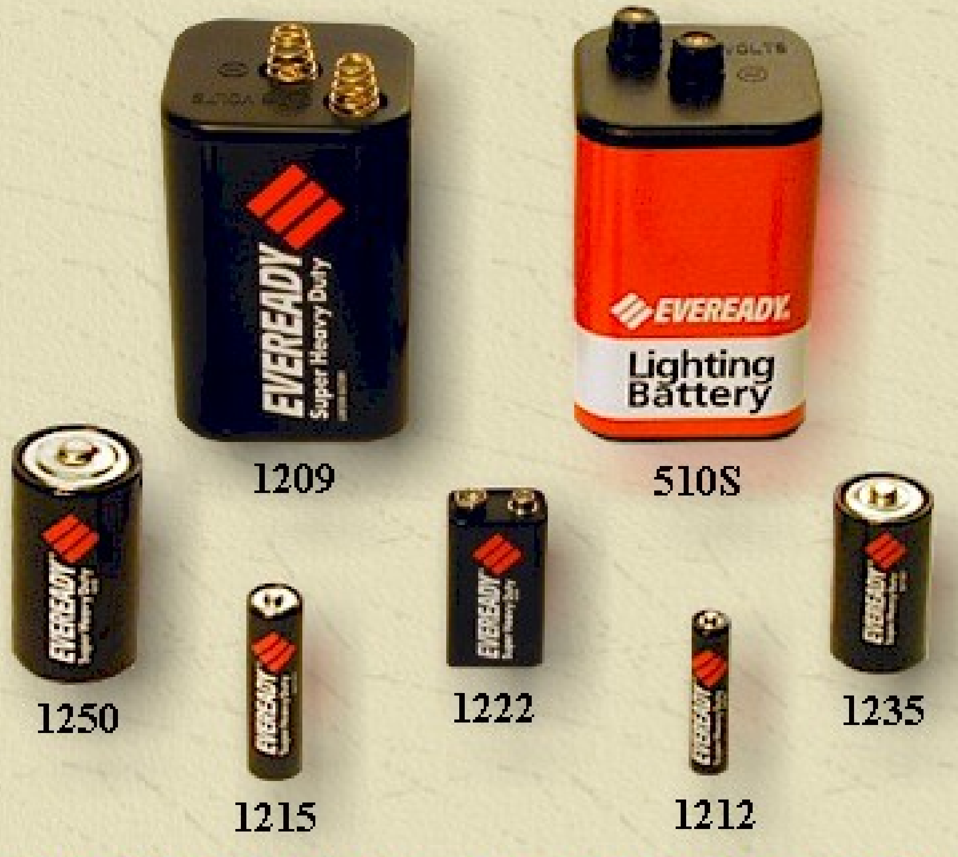
Contents

Contents

Carbon Zinc Consumer/OEM

Carbon Zinc Application Manual

HOME



CARBON ZINC - CONSUMER / OEM

(Click on battery to locate in table below.)

Click product "name" to view engineering datasheet or click "picture" to view larger image.

Name	Picture	Size	Capacity * (mAh)	Voltage (nom.)	ANSI/ NEDA	IEC	Weight (g)	Diam. (max mm)	Height (max mm)	Length (max mm)	Width (max mm)
1222		9V	400	9.0	1604D	6F22	37	N/A	48.5	26.4	17.5
1215		AA	950	1.5	15D	R6	15	14.3	50.1	N/A	N/A

1212		AAA	540	1.5	24D	R03	9.7	10.5	44.5	N/A	N/A
1235		C	3000	1.5	14D	R14	45	26.2	50	N/A	N/A
1250		D	5900	1.5	13D	R20	89	34.2	61.5	N/A	N/A
1209		Lantern	12000	6.0	908D	4R25	600	N/A	115	68.2	68.2
510S		Lantern	11000	6.0	915	4R25	653	N/A	109.5	66.7	66.7

*** Capacity rating based on light drain (1 to 25 mA) to 0.8 volts cutoff per cell. See datasheets for details. For active JIS numbers, refer to IEC.**

Manganese Dioxide

[Manganese Dioxide Application Manual]

HOME

Click product "name" to view engineering datasheet or click "picture" to view larger image.

Name	Picture	Size	Capacity * (mAh)	Voltage (nom.)	ANSI/ NEDA	IEC	Weight (g)	Diam. (max mm)	Height (max mm)
186		Button	80	1.5	1167A	LR43	1.4	11.6	4.2
189		Button	48	1.5	1168A	LR54	1.0	11.6	3.10
191		Button	31	1.5	1169A	LR55	0.9	11.6	2.2
192		Button	32	1.5	N/A	LR41	0.5	7.9	3.6
193		Button	53	1.5	N/A	LR48	0.9	7.9	5.4
A76		Button	150	1.5	1166A	LR44	2.3	11.6	5.4

A23		Button Stack	40	12	1811A	N/A	7.5	10.3	28.5
A27		Button Stack	18	12	N/A	N/A	4.4	8.0	28.2
A544		Button Stack	150	6	1414A	4LR44	11	13	25.2
E11A	N/A	Button Stack	38	6	N/A	N/A	4.0	10	16
E625G		Button	200	1.5	N/A	N/A	3.3	15.5	6.1

*** Capacity at Rating Drain. See datasheets for details.**
For active JIS numbers, refer to IEC.

Carbon Zinc Industrial

Carbon Zinc Application Manual

HOME MORE

CARBON ZINC - INDUSTRIAL

(Click on battery to locate in table below.)

Click product "name" to view engineering datasheet or click "picture" to view larger image.

Name	Picture	Size	Capacity * (mAh)	Voltage (nom.)	ANSI/ NEDA	IEC	Weight (g)	Diam. (max mm)	Height (max mm)	Length (max mm)	Width (max mm)
206		Multi Cell	200	9	1611	N/A	32	19.1	50.8	N/A	N/A
246		Multi Cell	850	9	1602	6F50-2	88	N/A	69.9	36	34.5

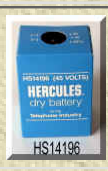
266		Multi Cell	2500	9	1605	N/A	168	N/A	63	46	46
276		Multi Cell	5000	9	1603	6F100	245	N/A	80.2	66	52
411		Multi Cell	140	15	208	10F20	27	N/A	37	27	16.1
412		Multi Cell	140	22.5	215	15F20	38	N/A	51	27	16.1
413		Multi Cell	140	30	210	20F20	48	N/A	65	27	16.1
415		Multi Cell	140	45	213	30F20	76	N/A	92.5	26.6	16.1
416		Multi Cell	140	67.5	217	N/A	114	N/A	88.9	33.7	25
504		Multi Cell	60	15	220	10F15	15.1	N/A	35	16	15.9
505		Multi Cell	60	22.5	221	15F15	21.8	N/A	51	16	15.9
EV115		AA	1375	1.5	15CD	LR6	15	14.5	50.5	N/A	N/A

EV122		9V	330	9	1604D	6F22	37	N/A	48.5	26.4	17.5
EV135		C	3125	1.5	14CD	R14	45	26.2	49.8	N/A	N/A
EV150		D	6050	1.5	13CD	R20	89	34.2	61.5	N/A	N/A

CARBON ZINC - INDUSTRIAL

(Click on battery to locate in table below.)

Name	Picture	Size	Capacity * (mAh)	Voltage (nom.)	ANSI/ NEDA	IEC	Weight (g)	Diam. (max mm)	Height (max mm)	Length (max mm)	Width (max mm)
455		Multi Cell	550	45	201	30F40	231	N/A	93.6	67.5	25.4

467		Multi Cell	550	67.5	200	45F40	343	N/A	95	71.4	35
489		Multi Cell	550	225	728	152F40	1.17 kg	N/A	106.4	110.3	68.3
493		Multi Cell	140	300	722	N/A	445	N/A	99.2	68.3	56.4
497		Multi Cell	140	180/510	741	336F20	780	N/A	142.9	76.2	41.2
711		Multi Cell	22000	1.5	700	R25-2	283	N/A	102.4	66.7	33.8
732		Multi Cell	7500	12	926	8R25	1.25 kg	N/A	125.4	135.7	72.2
763		Multi Cell	1650	22.5	710	N/A	372	N/A	77.8	92.1	51.6
EV131		Lantern	10000	6	918CD	4R25	1.25 kg	N/A	127.0	136.5	73.0
EV190		Lantern	11000	6	908CD	4R25X	589	N/A	112	66.7	66.7
HS14196		Multi Cell	950	22.5/45	205C	30R6	508	N/A	104.8	76.2	58.7

*** Capacity rating based on light drain (1 to 25 mA) to 0.8 volts cutoff per cell. See datasheets for details.
For active JIS numbers, refer to IEC.**

Lithium Cylindrical

L91 Lithium Application Manual   L522 Lithium Application Manual

HOME

Click product "name" to view engineering datasheet or click "picture" to view larger image.

Name	Picture	Size	Capacity* (mAh)	Voltage (nom.)	ANSI/ NEDA	IEC	Weight (g)	Diam. (max mm)	Height (max mm)	Length (max mm)	Width (max mm)
L91		AA	2900	1.5	15LF	N/A	14.5	14.3	50.5	N/A	N/A
2L76		Photo	160	3	N/A	N/A	3	11.6	10.8	N/A	N/A
CRV3		Photo	3000	3	N/A	N/A	38	N/A	52.2	28.6	14.4
EL123AP		Photo	1300	3	5018LC	N/A	15.5	17.0	34.5	N/A	N/A
EL1CR2		Photo	800	3	N/A	CR15 H270	11	15.6	27	N/A	N/A
EL2CR5		Photo	1500	6	5032LC	2CR5	39.5	N/A	45	34	17

EL223AP		Photo	1400	6	5024LC	CR-P2	37	N/A	36	35	19.5
L544		Photo	160	6	N/A	N/A	9	12.83	25.15	N/A	N/A
L522		Medical	1200	9	1604LC	N/A	34.4	N/A	48.5	26.3	16.9

*** Capacity at Rating Drain. See datasheets for details**
For active JIS numbers, refer to IEC.

Silver Oxide

Silver Oxide Application Manual

HOME

Click product "name" to view engineering datasheet or click "picture" to view larger image.

Name	Picture	Size	Capacity * (mAh)	Voltage (nom.)	ANSI/ NEDA	IEC	Weight (g)	Diam. (max mm)	Height (max mm)
301		Button	110	1.55	1132SO	SR43	1.7	11.6	4.2
303		Button	175	1.55	1130SO	SR44	2.55	11.6	5.6
309		Button	70	1.55	1136SO	SR48	1.13	7.9	5.4
315		Button	21	1.55	1187SO	SR67	0.33	7.9	1.65

317		Button	11.5	1.55	1185SO	SR62	0.19	5.8	1.65
319		Button	18	1.55	1186SO	SR64	0.31	5.8	2.7
321		Button	14	1.55	1174SO	SR65	0.28	6.8	1.65
329		Button	36	1.55	N/A	SR731SW	0.57	7.9	3.1
333		Button	5	1.55	N/A	SR610SW	0.16	6.8	1.05
335		Button	5	1.55	N/A	SR512SW	0.14	5.8	1.25
337		Button	7.5	1.55	N/A	SR416SW	0.12	4.8	1.65
339		Button	13.5	1.55	N/A	SR614SW	0.22	6.8	1.45
341		Button	13.5	1.55	1192SO	SR714SW	0.3	7.9	1.45
344		Button	105	1.55	1139SO	SR42	1.6	11.6	3.6
346		Button	9	1.55	N/A	SR713SW	0.23	7.9	1.3
350		Button	105	1.55	N/A	SR42	1.6	11.6	3.6
357		Button	175	1.55	1131SO	SR44	2.3	11.6	5.4
361		Button	23	1.55	1173SO	SR58	0.42	7.9	2.1
362		Button	23	1.55	1158SO	SR58	0.42	7.9	2.1
364		Button	19	1.55	1175SO	SR60	0.31	6.8	2.15

365		Button	32	1.55	N/A	SR1116W	0.7	11.6	1.65
366		Button	33	1.55	1177SO	SR1116SW	0.7	11.6	1.65
370		Button	35	1.55	1188SO	SR69	0.66	9.5	2.1
371		Button	34	1.55	1171SO	SR69	0.66	9.5	2.1
373		Button	26	1.55	1172SO	SR68	0.53	9.5	1.65
376		Button	26	1.55	N/A	SR66	0.42	6.8	2.6
377		Button	26	1.55	1176SO	SR66	0.42	6.8	2.6
379		Button	14	1.55	1191SO	SR63	0.25	5.8	2.15
381		Button	49	1.55	1170SO	SR55	0.93	11.6	2.1
384		Button	42	1.55	1134SO	SR41	0.57	7.9	3.6
386		Button	120	1.55	1133SO	SR43	1.7	11.6	4.2
387S		Button	60	1.55	N/A	N/A	1.0	11.6	3.6
389		Button	85	1.55	1138SO	SR54	1.35	11.6	3.05
390		Button	85	1.55	1159SO	SR54	1.35	11.6	3.05

391		Button	49	1.55	1160SO	SR55	0.93	11.6	2.1
392		Button	42	1.55	1135S0	SR41	0.57	7.9	3.6
393		Button	70	1.55	1137SO	SR48	1.13	7.9	5.4
394		Button	60	1.55	1161SO	SR45	1.11	9.5	3.6
395		Button	52	1.55	1162SO	SR57	0.79	9.5	2.7
396		Button	31.5	1.55	1163SO	SR59	0.51	7.9	2.6
397		Button	33	1.55	1164SO	SR59	0.51	7.9	2.6
399		Button	52	1.55	1165SO	SR57	0.79	9.5	2.7
EPX76		Button	200	1.55	1107SOP	SR44	2.27	11.6	5.4

*** Capacity at Rating Drain. See datasheets for details.**
For active JIS numbers, refer to IEC.

Eveready Battery Company, Inc.

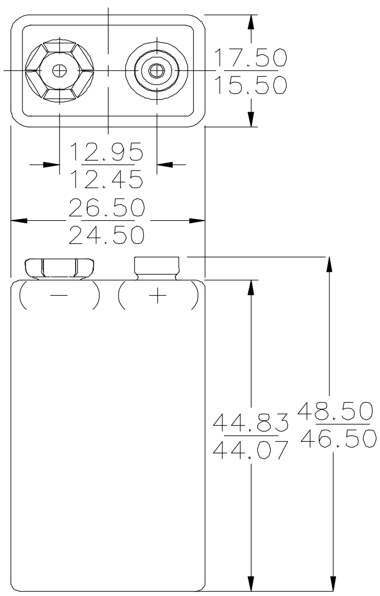
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Alkaline **9V**
No Added Mercury or Cadmium

EVEREADY NO. A522

Dimensions (mm)

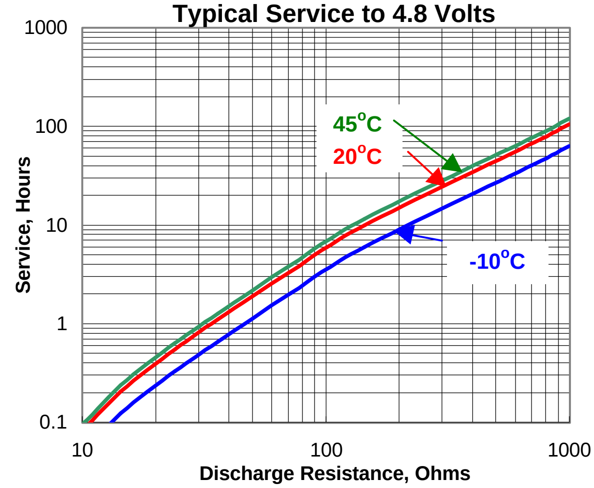


Millimeters	Inches
12.45	0.490
12.95	0.510
15.50	0.610
17.50	0.689
24.50	0.965
26.50	1.043
44.07	1.735
44.83	1.765
46.50	1.831
48.50	1.909

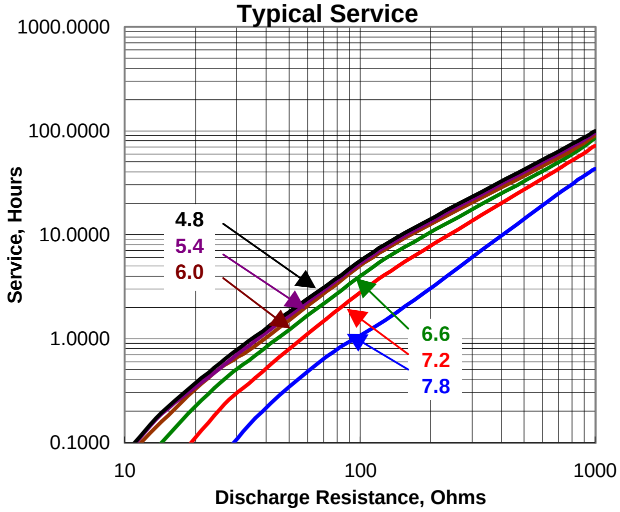
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-1604A, IEC-6LR61
Battery Voltage: 9 Volts
Average Weight: 45.6 grams (1.60 oz.)
Volume: 21.1 cubic centimeters (1.3 cubic inch)
Average Service capacity (to 0.8 Volts / cell): 595 mAh
(Rated Capacity at 25mA continuous drain)
Cell: Six No. 3-0316 in series
Jacket: Metal
Shelf Life: 5 years

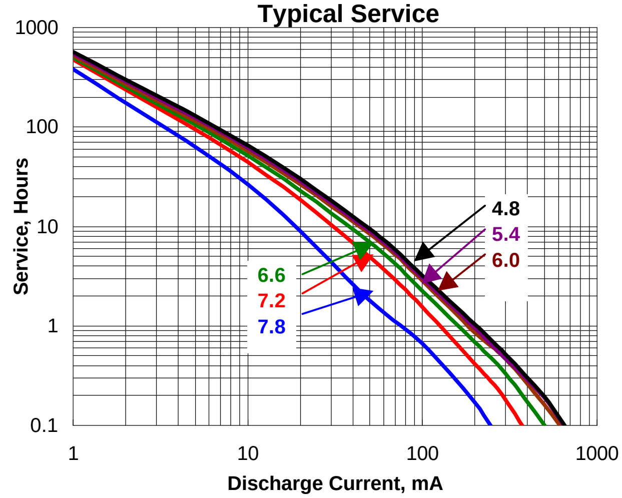
Temperature Effects
Typical Service to 4.8 Volts

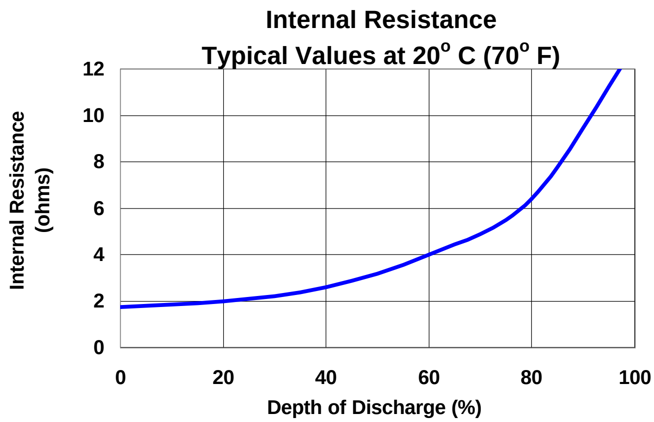


Constant Resistance Discharge
Typical Service

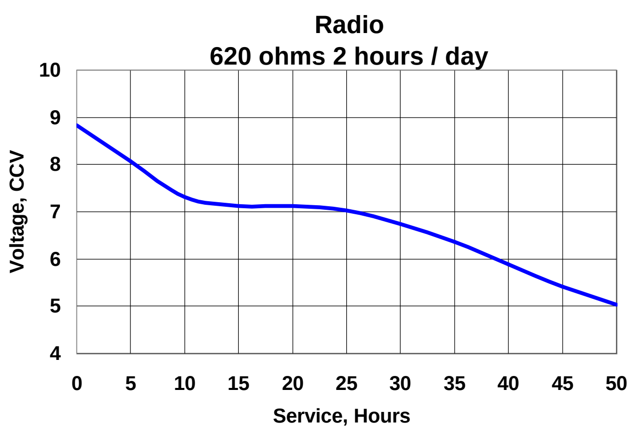


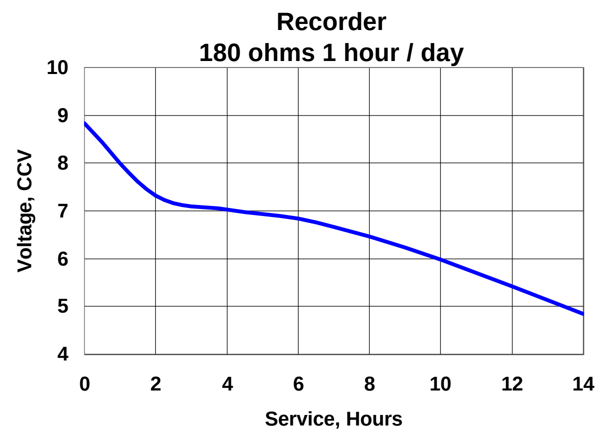
Constant Current Discharge
Typical Service

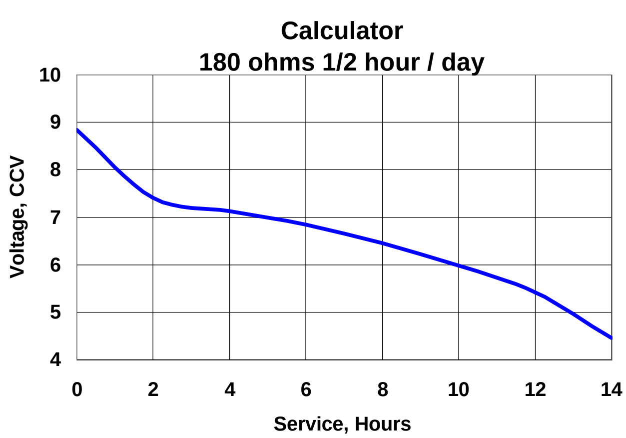


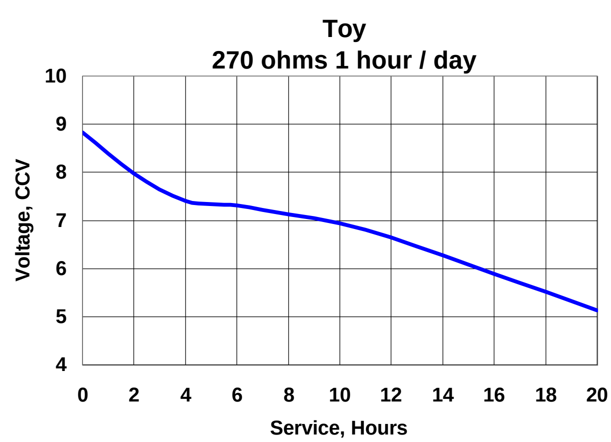


Typical Applications









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Eveready Battery Company, Inc.

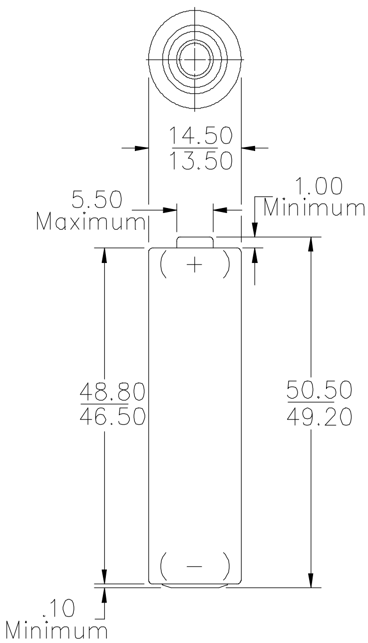
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

AA
Alkaline **1.5V**
No Added Mercury or Cadmium

ENERGIZER NO. A91

Dimensions (mm)

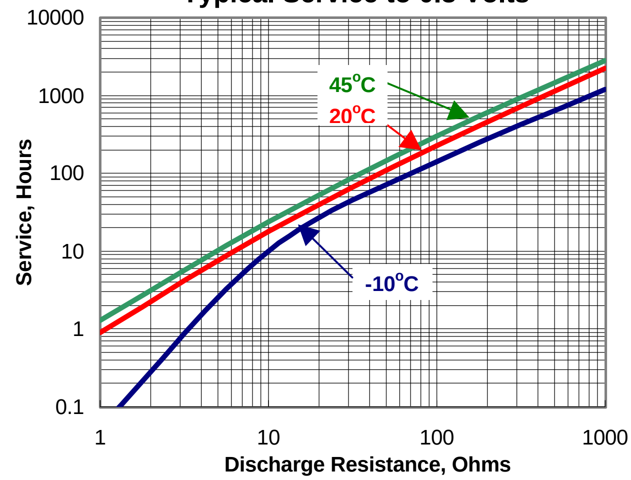


Millimeters	Inches
0.1	0.004
1.0	0.039
5.5	0.217
13.5	0.531
14.5	0.571
46.5	1.831
48.8	1.921
49.2	1.937
50.5	1.988

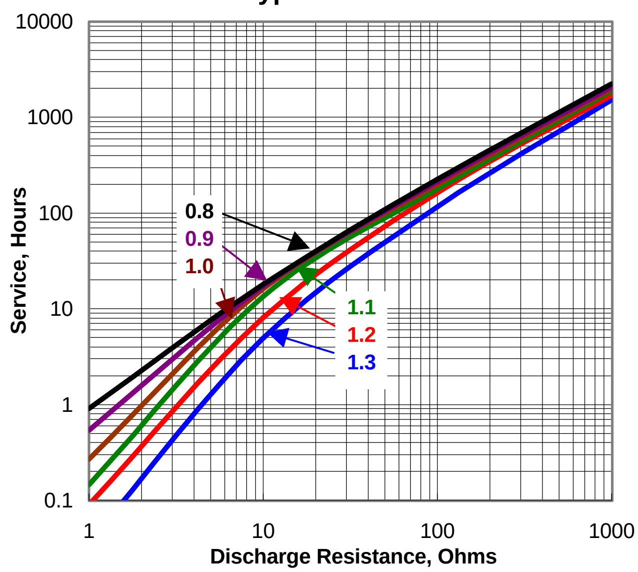
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-15A, IEC-LR6
Battery Voltage: 1.5 Volts
Average Weight: 23 grams (0.8oz.)
Volume: 8.1 cubic centimeters (0.5cubic inch)
Average Service capacity (to 0.8Volts / cell): 2565 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 3-315 (size "AA")
Jacket: Plastic Label
Shelf Life: 5 years

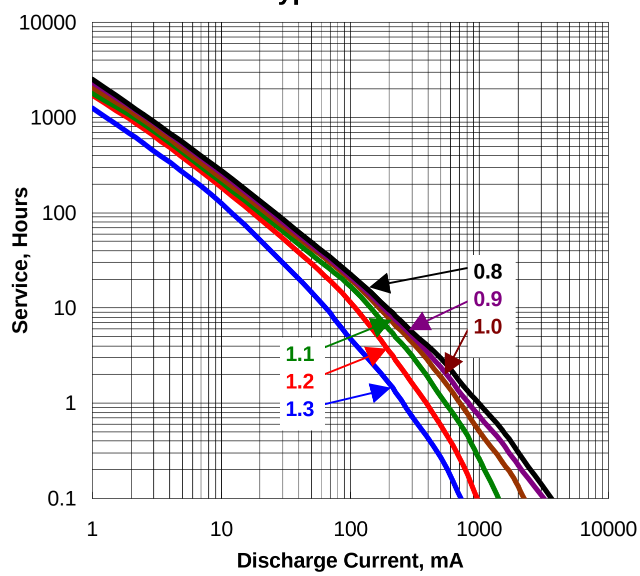
Temperature Effects
Typical Service to 0.8 Volts

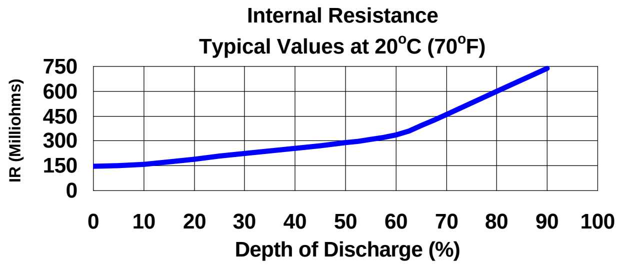


Constant Resistance Discharge
Typical Service

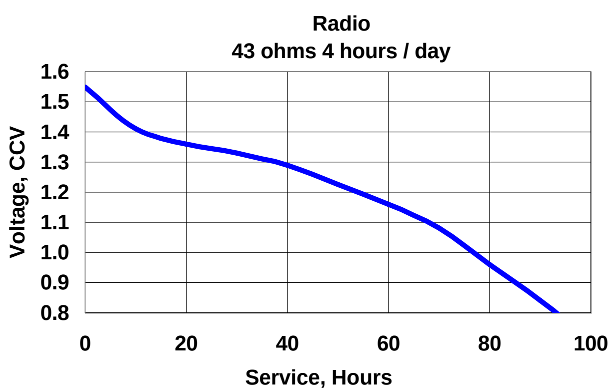


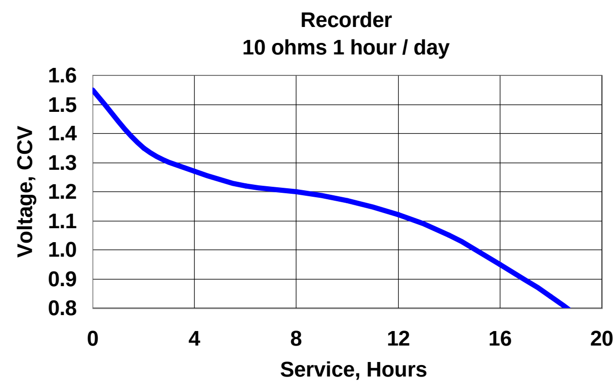
Constant Current Discharge
Typical Service

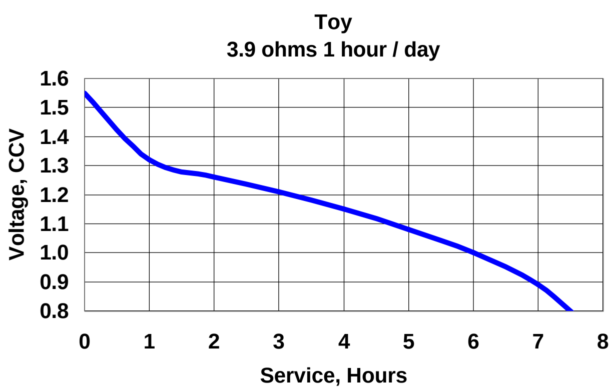


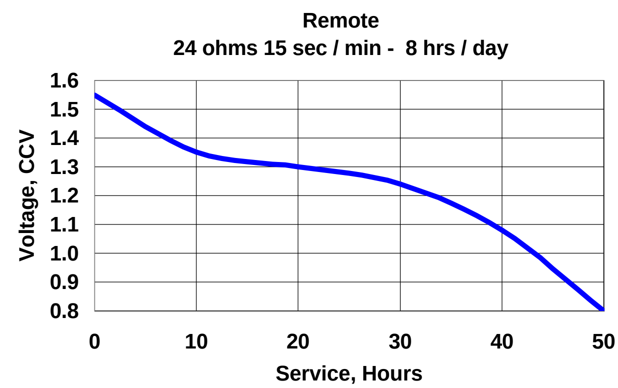


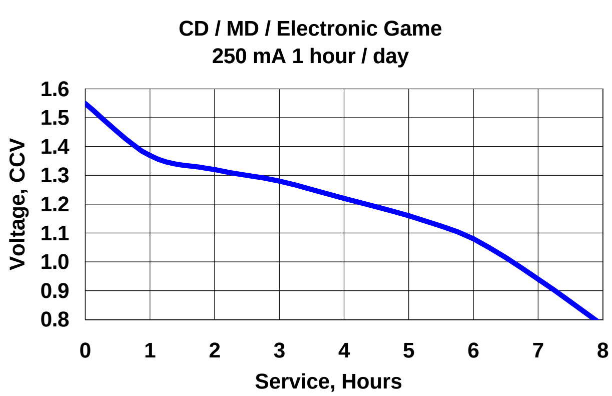
Typical Applications

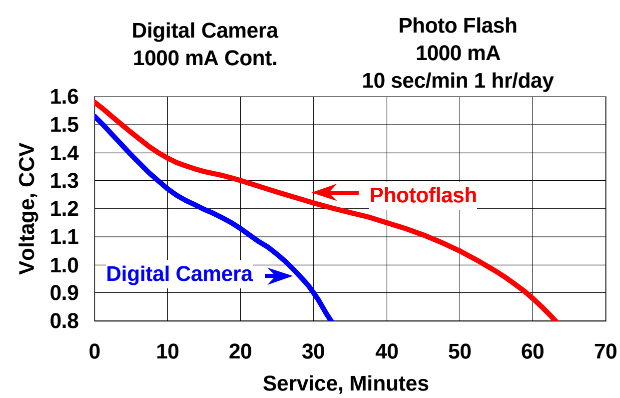












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Eveready Battery Company, Inc.

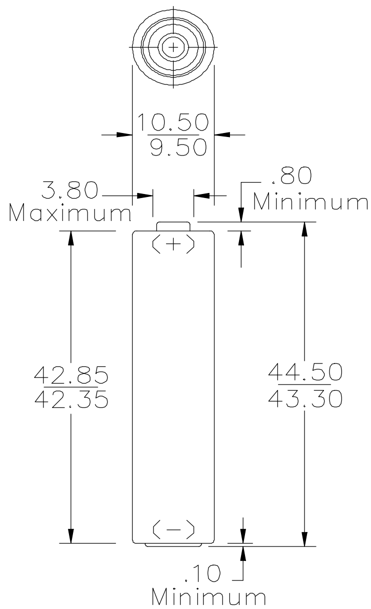
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

AAA
Alkaline **1.5V**
No Added Mercury or Cadmium

ENERGIZER NO. A92

Dimensions (mm)

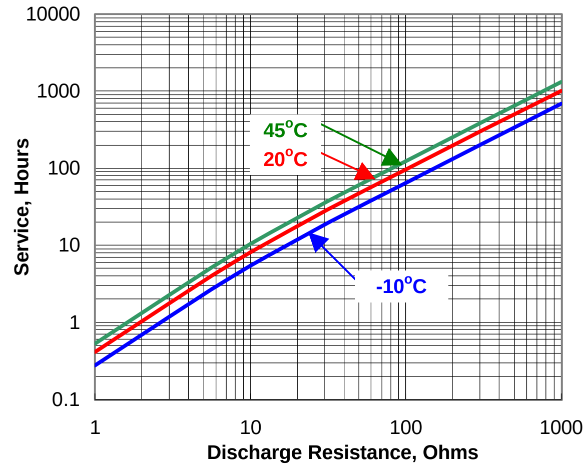


Millimeters	Inches
0.10	0.004
0.80	0.031
3.80	0.15
9.50	0.374
10.50	0.413
42.35	1.667
42.85	1.687
43.30	1.705
44.50	1.752

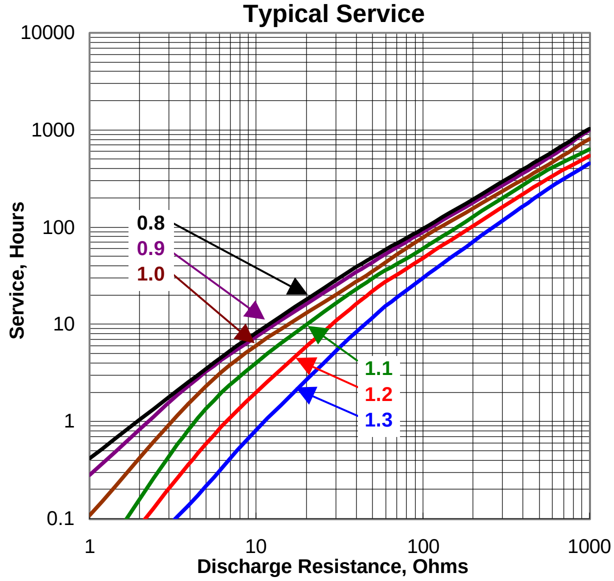
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-24A, IEC-LR03
Battery Voltage: 1.5 Volts
Average Weight: 11.5 grams (0.4 oz.)
Volume: 3.8 cubic centimeters (0.2 cubic inch)
Average Service capacity (to 0.8 Volts / cell): 1125 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 3-312 (size "AAA")
Jacket: Plastic Label
Shelf Life: 5 years

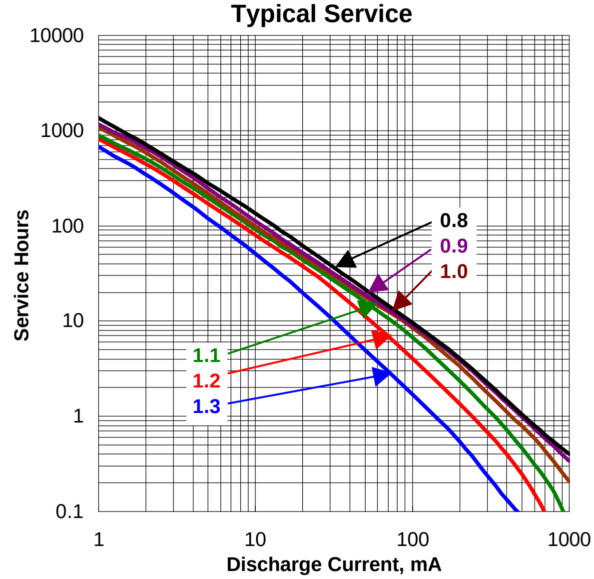
Temperature Effects
Typical Service to 0.8 Volts



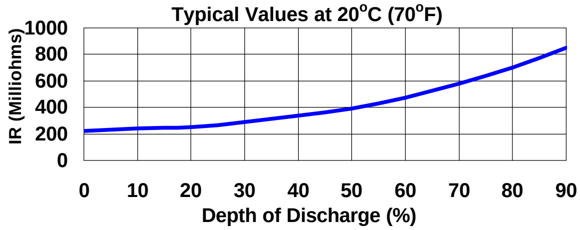
Constant Resistance Discharge
Typical Service



Constant Current Discharge
Typical Service

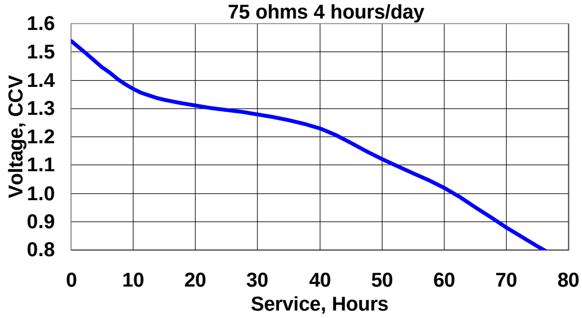


Internal Resistance
Typical Values at 20°C (70°F)

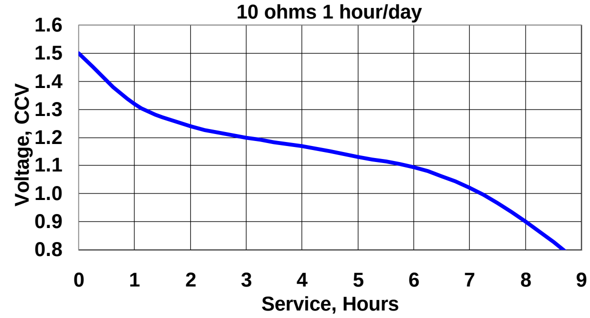


Typical Applications

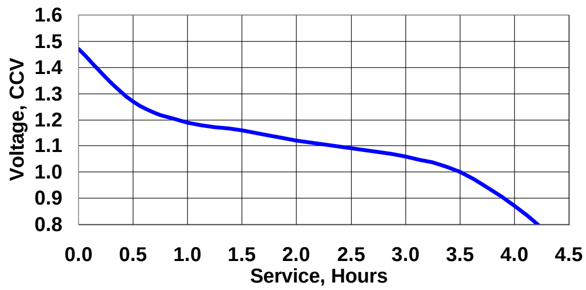
Radio
75 ohms 4 hours/day



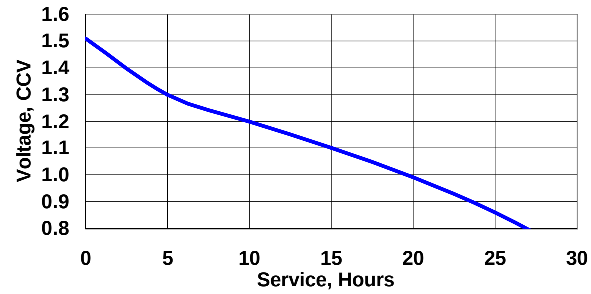
Tape Recorder
10 ohms 1 hour/day



Portable Lighting
5.1 ohms 4 min/hour, 8 hours/day

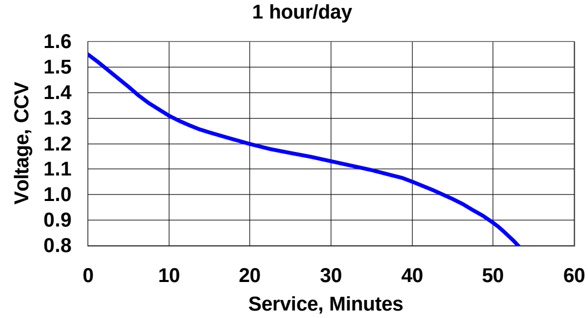


Remote
24 ohms 15 seconds/day 24 hours/day



Pager
1.2 mA Background
120 mA 10 sec/hr 24 hours/day

Photoflash
600 mA 10 sec/min
1 hour/day



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Eveready Battery Company, Inc.

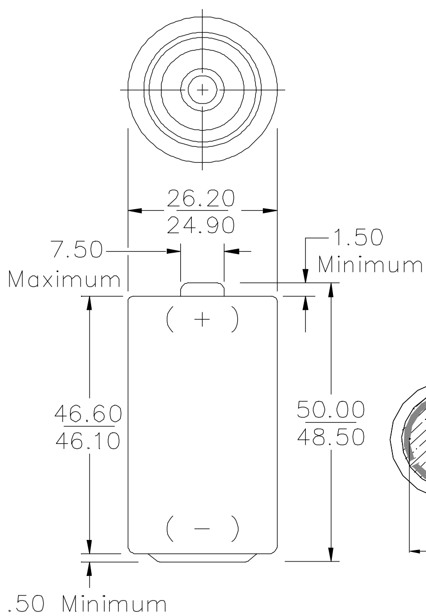
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

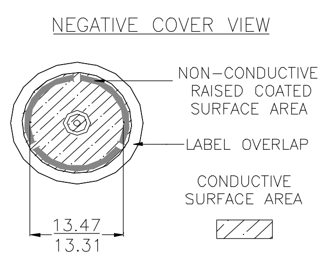
C
Alkaline **1.5V**
No Added Mercury or Cadmium

EVEREADY NO. A93

Dimensions (mm)



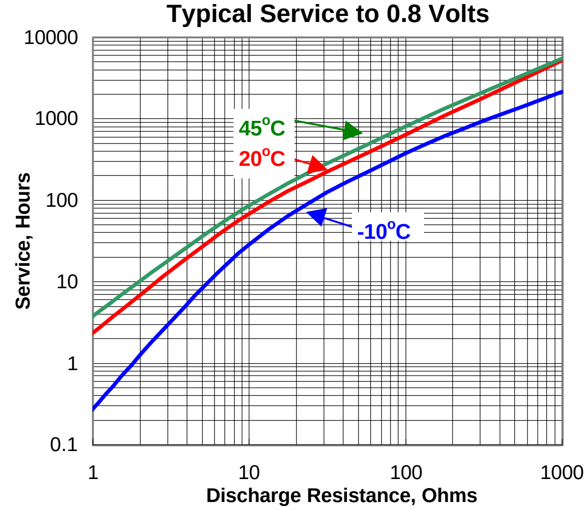
Millimeters	Inches
0.50	0.020
1.50	0.059
7.50	0.295
13.31	0.524
13.47	0.530
24.90	0.980
26.20	1.031
46.10	1.815
46.60	1.835
48.50	1.909
50.00	1.969



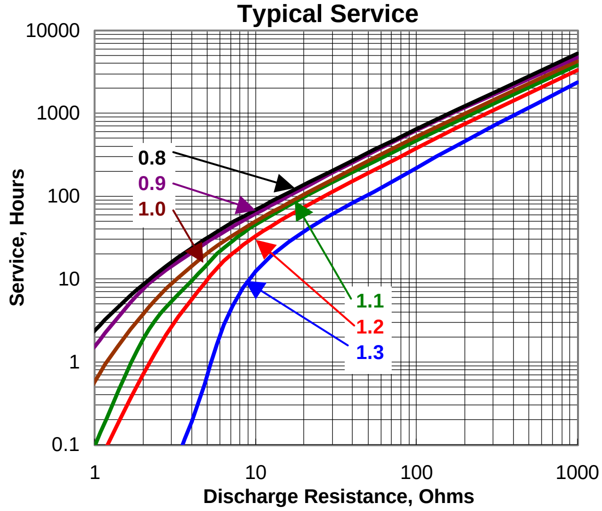
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-14A, IEC-LR14
Battery Voltage: 1.5 Volts
Average Weight: 66.2 grams (2.3 oz.)
Volume: 26.9 cubic centimeters (1.6 cubic inch)
Average Service capacity (to 0.8 Volts / cell): 8350 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 3-335 (size "C")
Jacket: Plastic Label
Shelf Life: 5 years

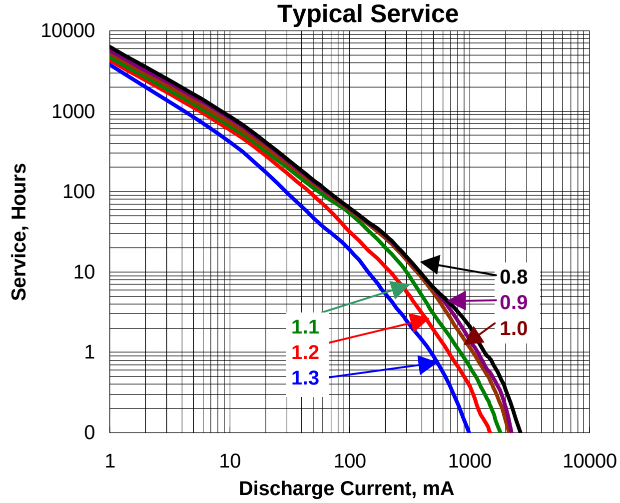
Temperature Effects
Typical Service to 0.8 Volts

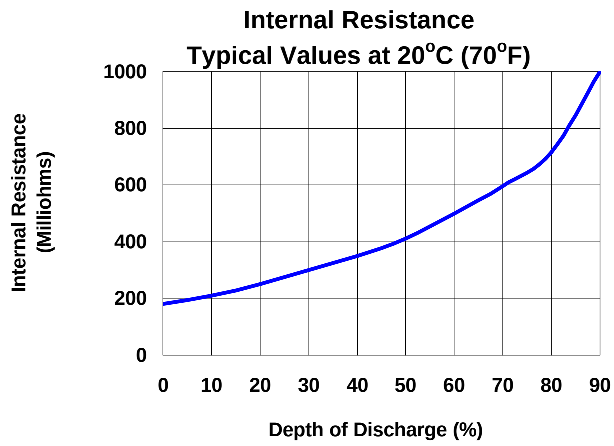


Constant Resistance Discharge
Typical Service

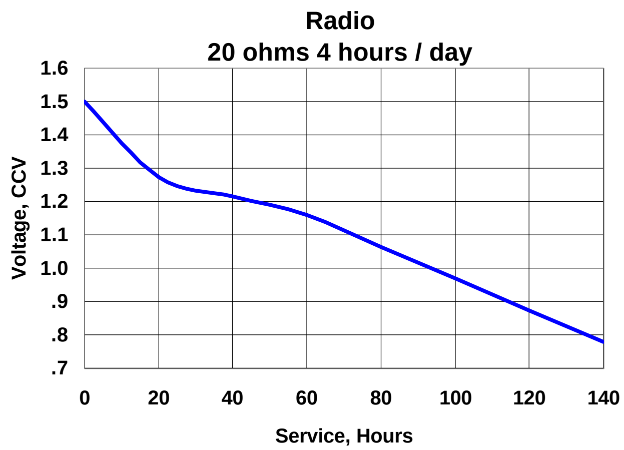


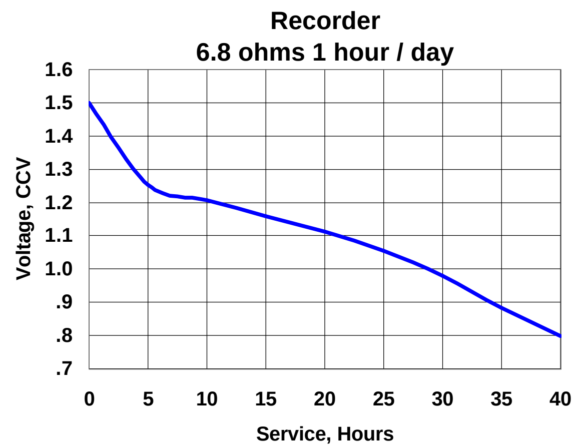
Constant Current Discharge
Typical Service

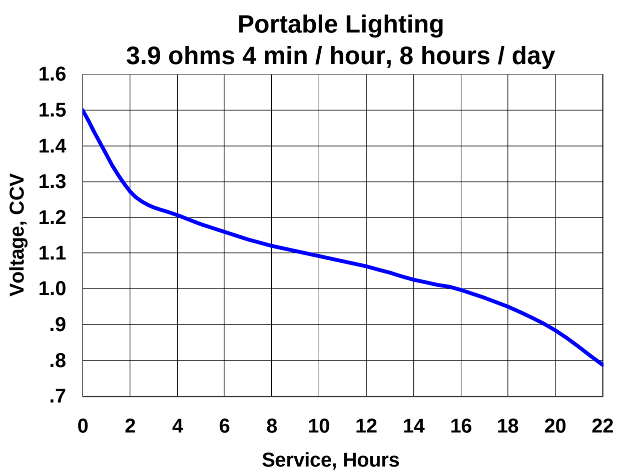


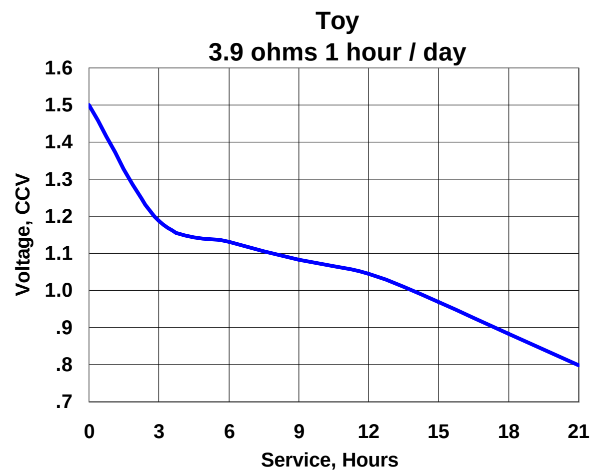


Typical Applications









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Eveready Battery Company, Inc.

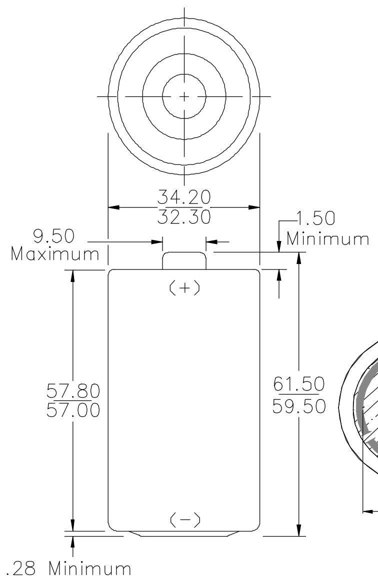
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

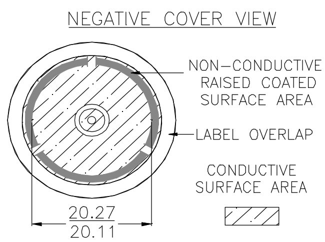
Engineering Data

D
Alkaline **1.5V**
No Added Mercury or Cadmium

EVEREADY NO. A95

Dimensions (mm)



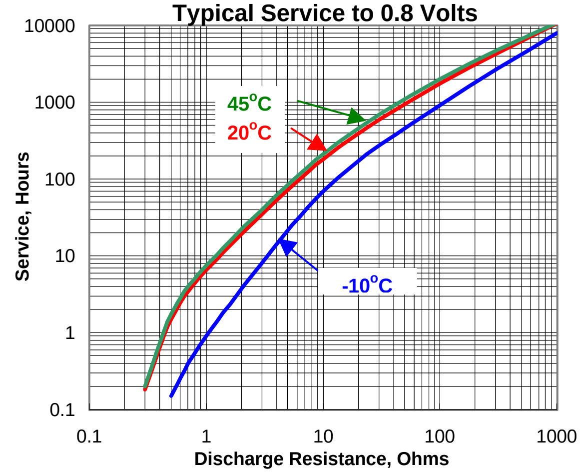


Millimeters	Inches
0.28	0.011
1.50	0.059
9.50	0.374
20.11	0.792
20.27	0.798
32.30	1.272
34.20	1.346
57.00	2.244
57.80	2.276
59.50	2.343
61.50	2.421

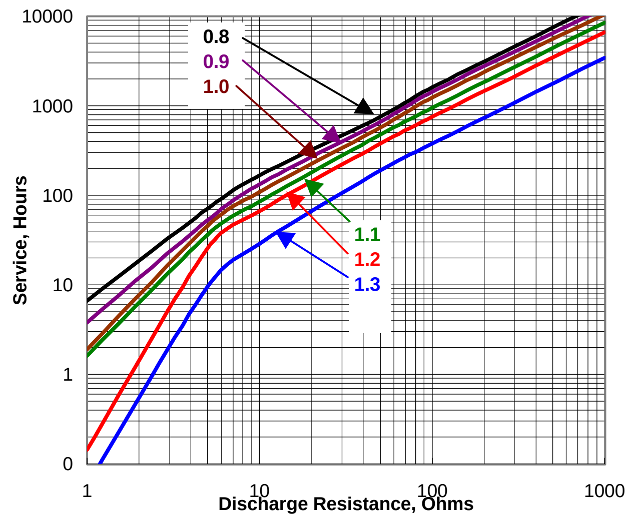
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-13A, IEC-LR20
Battery Voltage: 1.5 Volts
Average Weight: 141.9 grams (5.0 oz.)
Volume: 55.9 cubic centimeters (3.4 cubic inch)
Average Service capacity (to 0.8 Volts / cell): 18000 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 3-350 (size "D")
Jacket: Plastic Label
Shelf Life: 5 years

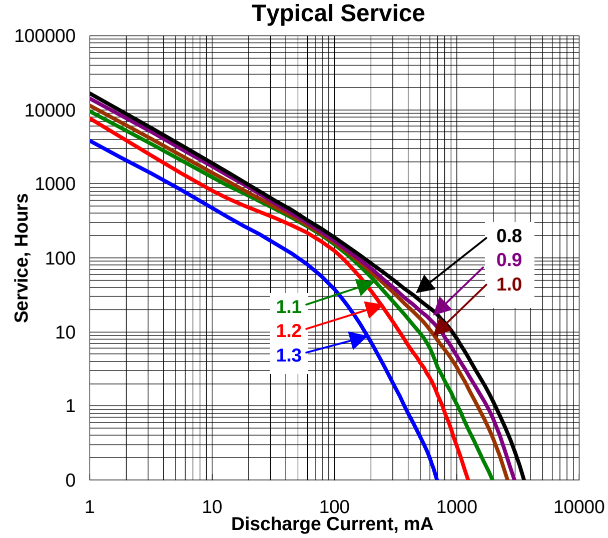
Temperature Effects
Typical Service to 0.8 Volts



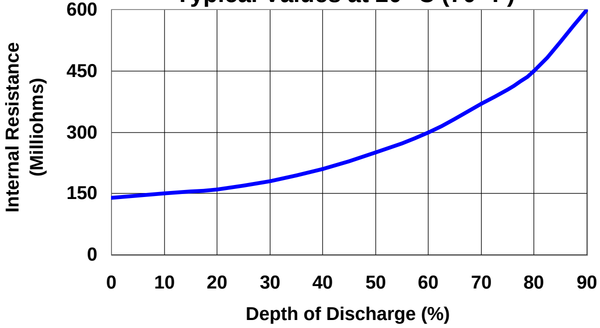
Constant Resistance Discharge
Typical Service



Constant Current Discharge
Typical Service

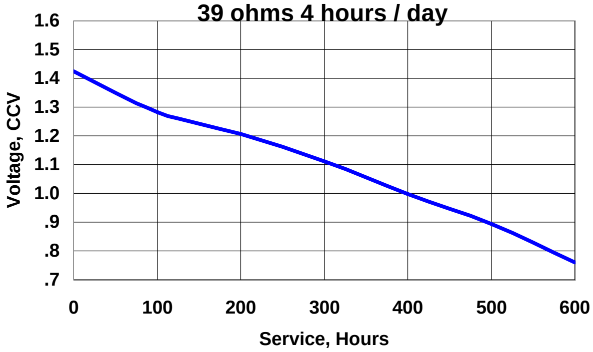


Internal Resistance
Typical Values at 20° C (70° F)

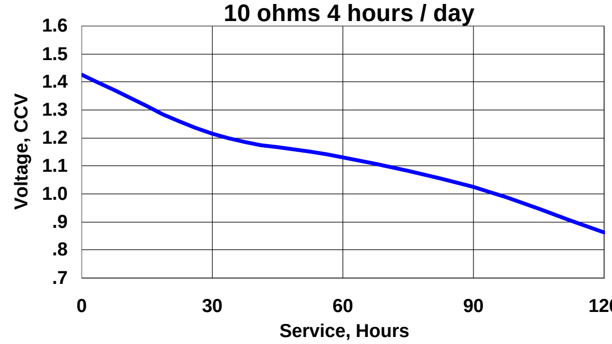


Typical Applications

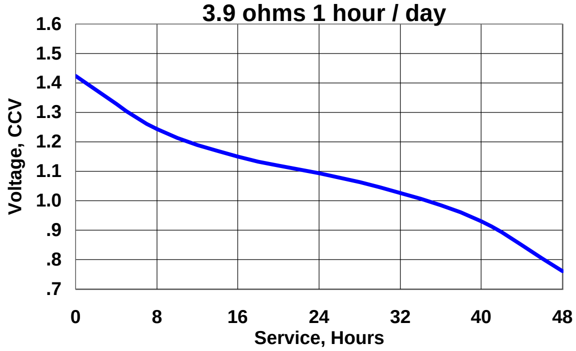
Radio
39 ohms 4 hours / day



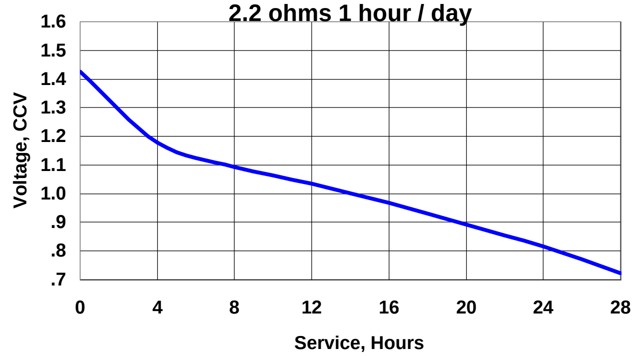
Recorder
10 ohms 4 hours / day



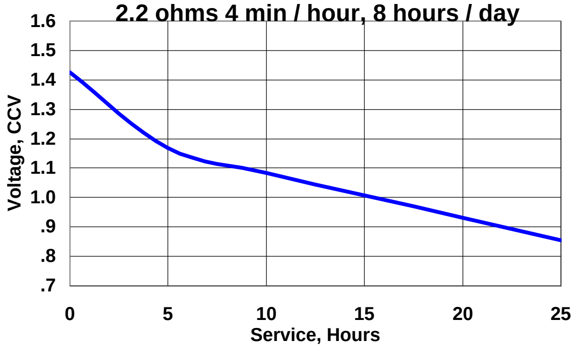
Recorder
3.9 ohms 1 hour / day



Toy
2.2 ohms 1 hour / day



Portable Lighting
2.2 ohms 4 min / hour, 8 hours / day



Important Notice

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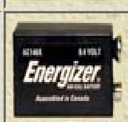
Zinc Air

Zinc Air Application Manual

HOME

Zinc Air Batteries

(Click on battery to locate in table below.)

Click product "name" to view engineering datasheet or click "picture" to view larger image.											
Name	**Picture**	**Size**	**Capacity * (mAh)**	**Voltage (nom.)**	**ANSI/ NEDA**	**IEC**	**Weight (g)**	**Diam. (max mm)**	**Height (max mm)**	**Length (max mm)**	**Width (max mm)**
AC5		Button	33	1.4	7012ZD	PR63	0.2	5.8	2.15	N/A	N/A
AC10/230		Button	70	1.4	7005ZD	PR70 PR536	0.3	5.8	3.6	N/A	N/A
AC13		Button	255	1.4	7000ZD	PR48	0.8	7.8	5.4	N/A	N/A
AC312		Button	130	1.4	7002ZD	PR41	0.5	7.8	3.6	N/A	N/A
AC675		Button	600	1.4	7003ZD	PR44	1.9	11.6	5.4	N/A	N/A
AC146X		9 V	1100	8.4	7004Z	N/A	33	N/A	44.5	26.5	16.6

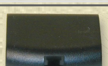
*** Capacity at Rating Drain. See datasheets for details.**
For active JIS numbers, refer to IEC.

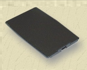
Rechargeable Cellular Packs

Back to Rechargeable Product Offerings Table

HOME

Click product "name" to view engineering datasheet or click "picture" to view larger image.

Name	Picture	Phone Brand	Typical Capacity* (mAh)	Voltage (nom.)	Weight (g)	Height (max mm)	Length (max mm)	Width (max mm)	Chemistry
CP2360		NOKIA 2100 SERIES	1800	6	190	99.3	56.1	23.1	NiMH
CP3036		Motorola / StarTAC	900	3.6	46	41.9	51.8	12.2	Li-Ion
CP3136		NOKIA 5100 / 6100	900	3.6	--	103.4	45.5	12.2	Li-Ion
CP3336		Nextel i1000	950	3.6	N / A	N / A	N / A	N / A	Li-Ion
CP5136		NOKIA 5100 / 6100	950	3.6	75	103.6	44.9	14.9	NiMH
CP5648		Ericsson, General Electric	600	4.8	N / A	N / A	N / A	N / A	NiMH
CP5748		Ericsson 700	600	4.8	61	60.5	48.8	12.2	NiMH
CP8049		Nokia 918	1200	4.8	N / A	N / A	N / A	N / A	NiMH
CP8648		Ericsson 600	1200	4.8	133	111.5	45.8	18.3	NiMH
CPV5136		Nokia 6100	950	3.6	74.8	103.6	44.9	14.9	Li-Ion
ACP5036		Motorola StarTAC	N / A	4.5	11.44 WB	41.9	51.8	14.3	Primary Alkaline

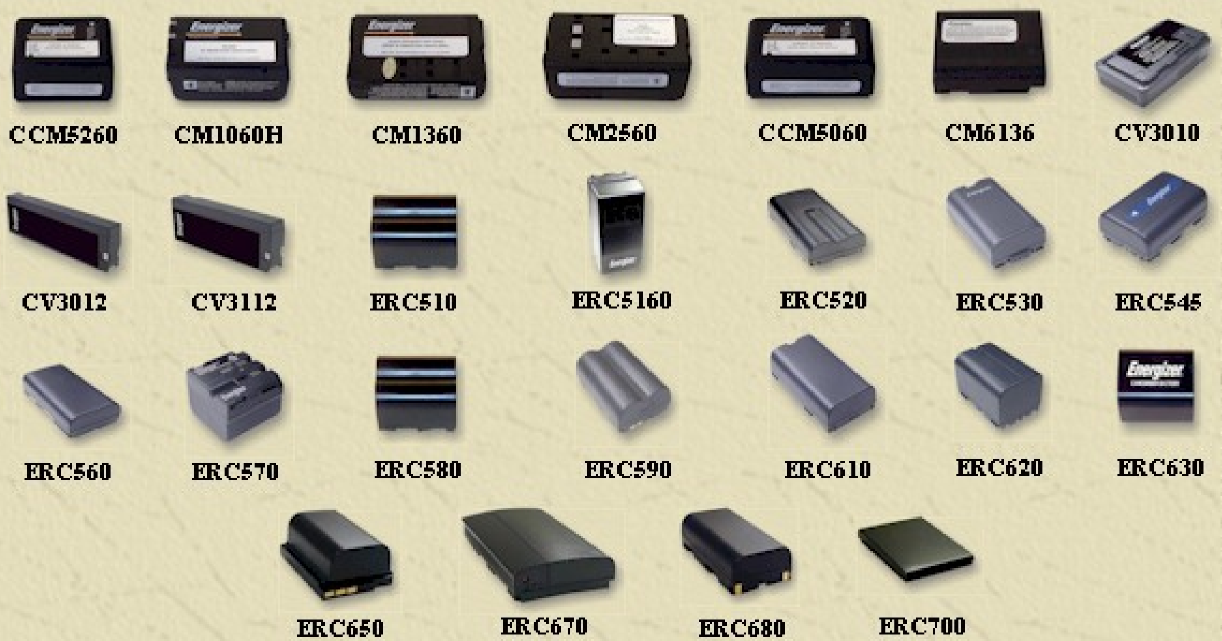
ACP5136		Nokia 5100-7100	N / A	4.5	55.4 WB	103.6	44.9	14.9	Primary Alkaline
ACP7160		Motorola MicroTAC	N / A	9	180.8 WB	120.9	58.9	19.3	Primary Alkaline
ERW120		Ericsson T28 series, T29, T39, R320, T36M R520M	850	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW210		Motorola i1000	1150	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW220		Motorola Stratac, Timeport P-series, P8090, Talktime	850	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW230		Motorola Stratac, Talktime, SP8160, P8167, etc.	1150	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW240	N / A	Motorola T2200, V2200, V2300 series	800	3.6	N / A	N / A	N / A	N / A	NiMH
ERW305		Nokia 5100, 6100, 7100	1200	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW310		Nokia 8200, 8800	850	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW320		Nokia 3360 / 3390	900	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW400		Qualcomm QCP-2035	600	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW500		Samsung 3500	1040	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW510		Samsung 8500	1150	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW520		Samsung N200	1400	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW530	N / A	Samsung N300	850	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW600		Audiovox 4000 / 4500 / 9000	900	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW610		Audiovox 9100	720	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW700	N / A	LGIC 510	900	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW720	N / A	LG 5200	1400	3.6	N / A	N / A	N / A	N / A	Li-Ion
ERW800		Sanyo 4000 / 4700	1200	3.6	N / A	N / A	N / A	N / A	Li-Ion

**** Based on a C/5 discharge to 0.9 volts per cell. See datasheets for details.***

Rechargeable Camcorder Packs

[Back to Rechargeable Product Offerings Table]

HOME

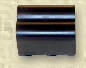


CAMCORDER BATTERIES

(Click on battery to locate in table below.)

Click product "name" to view engineering datasheet or click "picture" to view larger image.

Name	Picture	Camera Brand	Typical Capacity* (mAh)	Voltage (nom.)	Weight (g.)	Height (max mm)	Length (max mm)	Width (max mm)	Chemistry
CCM5060		JVC/Sony/ Sharp/ Panasonic	3600	6	363.2	89.2	46.2	46.2	Nickel Metal Hydride
CCM5260		JVC/Sony/ Sharp/ Panasonic	2000	6	--	89.4	47.0	25.9	Nickel Metal Hydride
CM1060H		Canon	1800	6	274.5	90.2	47.4	46.3	Nickel Cadmium
CM1360		Hitachi/RCA	1200	6	170	74.5	46.6	19.5	Nickel Cadmium
CM2560		Sony/Sanyo Sharp	1800	6	303.1	89.7	49.3	45.2	Nickel Cadmium
CM6136		Sharp	2700	3.6	134	53.6	55.6	19.6	Nickel Metal Hydride
CV3010		GE/Hitachi/Minolta Radio Shack RCA Sears/Zenith	2000	10	N/A	N/A	N/A	N/A	Sealed Lead Acid
CV3012		GE/Panasonic Magnavox	2300	12	N/A	N/A	N/A	N/A	Sealed Lead Acid
CV3112		GE/Panasonic Magnavox	2000	12	N/A	N/A	N/A	N/A	Sealed Lead Acid

ERC510		Sharp	1150	7.4	90.8	42.3	53.4	39.40	Lithium Ion
ERC5160		Sony / JVC / RCA Panasonic / Sharp	2000	6	N / A	N / A	N / A	N / A	Nickel Metal Hydride
ERC520		Sony	1850	7.2	N / A	N / A	N / A	N / A	Lithium Ion
ERC525	N / A	Sony	3700	7.2	N / A	N / A	N / A	N / A	Lithium Ion
ERC530		Panasonic	850	7.2	N / A	N / A	N / A	N / A	Lithium Ion
ERC545		Sony	1200	7.2	N / A	N / A	N / A	N / A	Lithium Ion
ERC560		Canon	1450	7.2	N / A	N / A	N / A	N / A	Lithium Ion
ERC570		Canon	5400	3.6	N / A	N / A	N / A	N / A	Nickel Metal Hydride
ERC580		Sharp	2300	7.4	151.66	42.3	53.4	39.40	Lithium Ion
ERC590		Canon	1200	7.2	N / A	N / A	N / A	N / A	Lithium Ion
ERC600	N / A	Canon	2400	7.4	N / A	N / A	N / A	N / A	Lithium Ion
ERC610		Hitachi / JVC Panasonic Proscan / RCA	1550	7.2	N / A	N / A	N / A	N / A	Lithium Ion
ERC620		JVC	1600	7.2	N / A	N / A	N / A	N / A	Lithium Ion
ERC630		Panasonic	1600	7.2	113.98	37.3	59.6	36.1	Lithium Ion
ERC640	N / A	Sony	2400	7.2	N / A	N / A	N / A	N / A	Lithium Ion
ERC650		JVC	1650	7.2	N / A	N / A	N / A	N / A	Lithium Ion
ERC660	N / A	JVC	1650	7.2	N / A	N / A	N / A	N / A	Lithium Ion
ERC670		JVC / Panasonic	2050	9.6	N / A	N / A	N / A	N / A	Nickel Metal Hydride
ERC680		Samsung	1800	7.2	N / A	N / A	N / A	N / A	Lithium Ion
ERC700		JVC	700	7.2	N / A	N / A	N / A	N / A	Lithium Ion

**** Based on a C/5 discharge to 0.9 volts per cell. See datasheets for details.***

Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

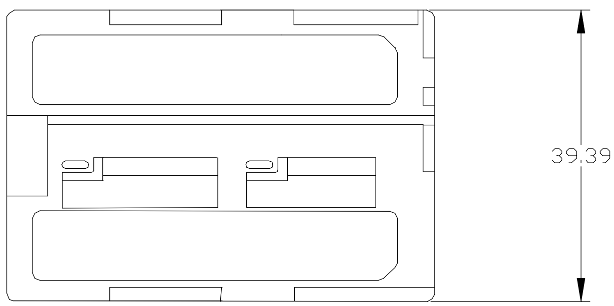
Engineering Data

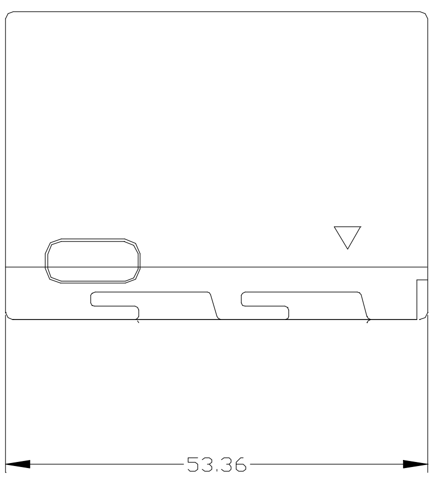
ENERGIZER NO. ER-C510

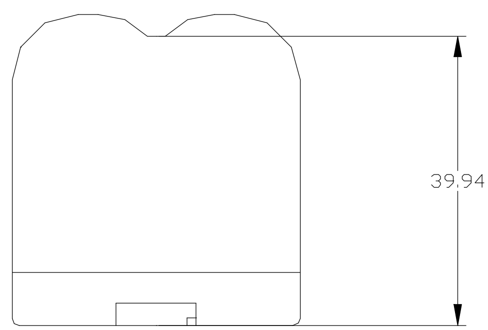
Designation: Lithium Ion Camcorder Battery
For Sharp
Nominal Voltage: 7.4 VDC
Typical Capacity: 1150mAh
Typical Weight: 90.8 grams (3.2 oz.)

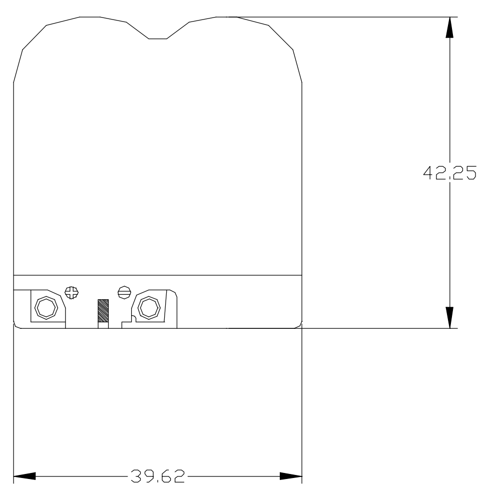
Dimensions (mm)

Millimeters	Inches
39.39	1.551
39.62	1.560
39.94	1.572
42.25	1.663
53.36	2.101









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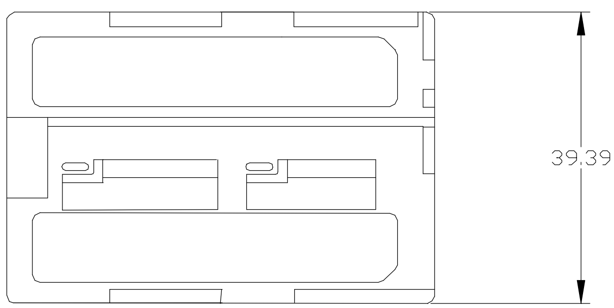
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

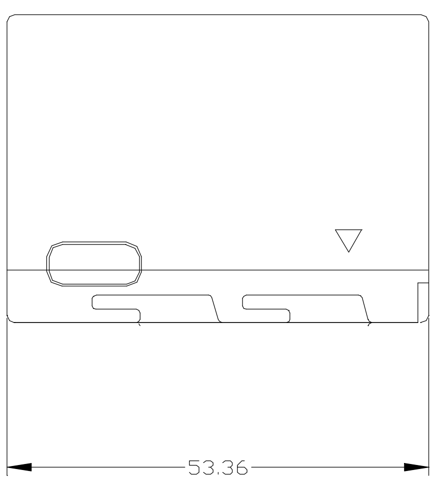
ENERGIZER NO. ER-C580

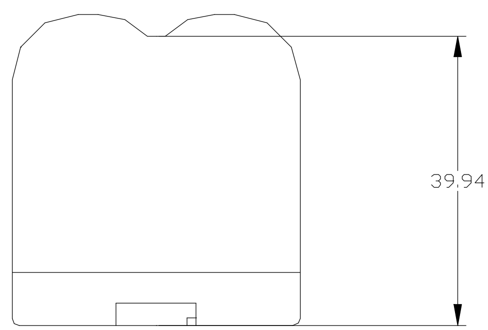
Designation: Lithium Ion Camcorder Battery
For Sharp
Nominal Voltage: 7.4 VDC
Typical Capacity: 2300mAh
Typical Weight: 151.66 grams (5.4oz.)

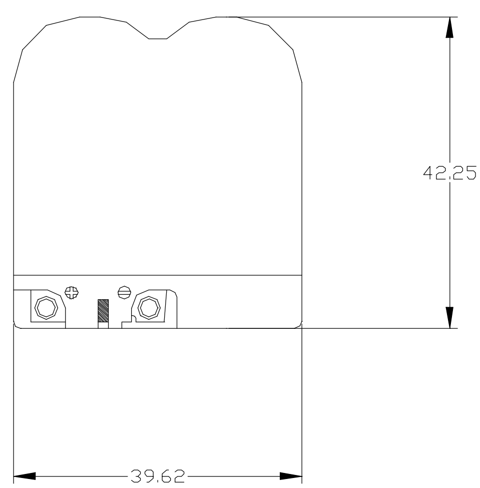


Dimensions (mm)

Millimeters	Inches
39.39	1.551
39.62	1.560
39.94	1.572
42.25	1.663
53.36	2.101







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Energizer

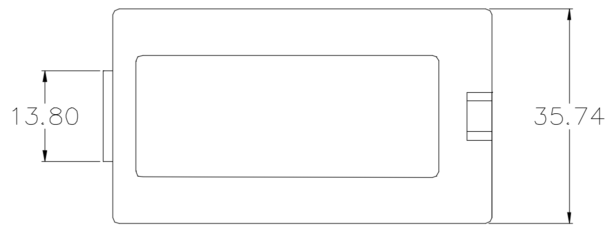
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

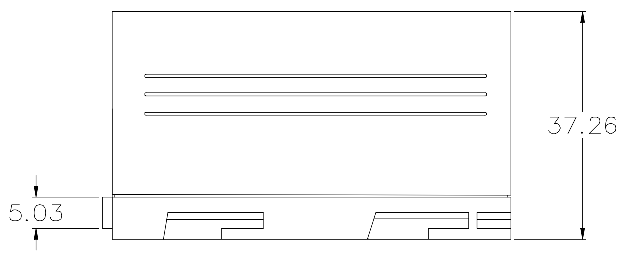
ENERGIZER NO. ER-C630

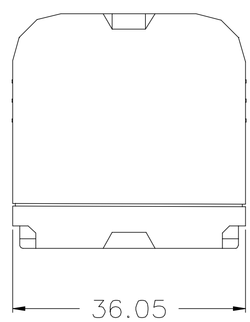
Designation: Lithium Ion Camcorder Battery
For Panasonic
Nominal Voltage: 7.2 VDC
Typical Capacity: 1600mAh
Typical Weight: 113.98 grams (4.0 oz.)

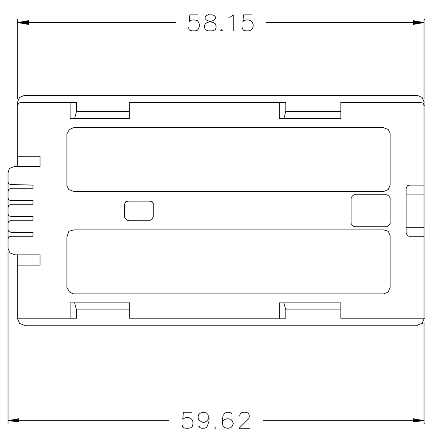


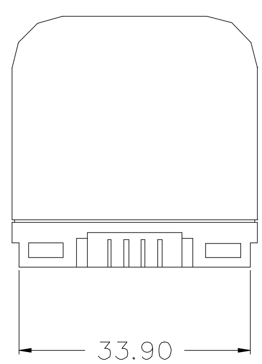
Dimensions (mm)

Millimeters	Inches
5.03	0.198
13.80	0.543
33.9	1.335
35.74	1.407
36.1	1.419
37.26	1.467
58.15	2.289
59.62	2.347









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Rechargeable Digital Camera Packs

Back to Rechargeable Product Offerings Table

HOME

ERD100 ERD110 ERD200 ERD300

DIGITAL CAMERA BATTERIES

(Click on battery to locate in table below.)

Click product "name" to view engineering datasheet or click "picture" to view larger image.

Name	**Picture**	**Camera Brand**	**Typical Capacity*** (mAh)	**Voltage** (nom.)	**Chemistry**
ERD100		Canon	630	3.7	Lithium Ion
ERD110		Canon	640	3.0	Nickel Metal Hydride
ERD200		Fuji, Kodak, Leica, Ricoh, Toshiba	1200	3.6	Lithium Ion
ERD300		Nikon	650	7.4	Lithium Ion

**** Based on a C/5 discharge to 0.9 volts per cell.***

Rechargeable Cordless Phone Packs

Back to Rechargeable Product Offerings Table

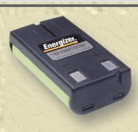
HOME

CORDLESS PHONE BATTERIES

(Click on battery to locate in table below.)

Click product "name" to view engineering datasheet or click "picture" to view larger image.

Name	**Picture**	**Phone Brand**	**Typical Capacity*** (mAh)	**Voltage** (nom.)	**Chemistry**
ERP107		Panasonic, AT&T, Emerson, Sony, Sanyo	400	3.6	Nickel Metal Hydride
ERP110		Panasonic, Philips, Samsung, Sanyo, Hi-tel	400	3.6	Nickel Metal Hydride
ERP240		AT&T, GE, Casio/Phonemate, V-tech	1000	3.6	Nickel Metal Hydride
ERP268		AT&T, Philips	1200	3.6	Nickel Metal Hydride

ERP275		GE	600	3.6	Nickel Cadmium
ERP290		V-tech	1500	2.4	Nickel Metal Hydride
ERP450		Panasonic	1150	3.6	Nickel Metal Hydride
ERP506	N / A	Panasonic	1500	2.4	Nickel Metal Hydride
ERP509	N / A	Panasonic	1500	2.4	Nickel Metal Hydride
ERP730	N / A	Cobra, Panasonic, Southwestern Bell, Uniden, Toshiba	1500	3.6	Nickel Metal Hydride
ERP9116	N / A	V-tech	1000	3.6	Nickel Metal Hydride
P2312		Bell South, Northwest Bell, Radio Shack, Sony, Toshiba, Uniden	280	3.6	Nickel Cadmium
P2322M		Motorola, Panasonic Uniden	300	3.6	Nickel Metal Hydride
P2331		Motorola, Cobra	280	3.6	Nickel Cadmium
P3201		GE	300	2.4	Nickel Cadmium
P3301		Cobra / GE, AT&T,Northwest Bell, Panasonic, Sanyo, Uniden, V-tech	300	3.6	Nickel Cadmium
P3302		Toshiba, Panasonic, Uniden, Sony, Telemed, Lucent, ITT, AT&T	300	3.6	Nickel Cadmium

P3303		AT&T / GE, Lucent, Magnavox, NW Bell, Philips, Phonemate, Sharp, Sony, V-tech	300	3.6	Nickel Cadmium
P3306		Bell Phone, Bell South	300	3.6	Nickel Cadmium
P3391		Conair, GE, SWBell	300	3.6	Nickel Cadmium
P5256		Sony, Uniden	500	4.0	Lead Acid
P7300		Panasonic	600	3.6	Nickel Cadmium
P7301		Cobra, GE, ITT, NW Bell, Samsung, Sanyo, Uniden	700	3.6	Nickel Cadmium
P7302		AT&T, Bell Phone, Cobra, Memorex, NW Bell, Panasonic, Sharp, Sony, Toshiba, Uniden	700	3.6	Nickel Cadmium
P7310		AT&T, Lucent, Philips, Sharp, Sony, Toshiba, V-Tech	600	3.6	Nickel Cadmium
P7320		Panasonic	600	3.6	Nickel Cadmium
P7330		Toshiba, Uniden	600	3.6	Nickel Cadmium
P7340		AT&T, Philips	700	3.6	Nickel Cadmium
P7350		GE	720	3.6	Nickel Cadmium
P7360		AT&T, V-Tech	600	3.6	Nickel Cadmium

P7400		AT&T, GE, Lucent, SW Bell	700	4.8	Nickel Cadmium
P7501		AT&T, Lucent	1000	6.0	Nickel Metal Hydride

*** *Based on a C/5 discharge to 0.9 volts per cell. See datasheets for details.***

NiMH

Nickel Metal Hydride Application Manual

HOME

NiMH BATTERIES

(Click on battery to locate in table below.)

Click product "name" to view engineering datasheet or click "picture" to view larger image.

Name	Picture	Size	Typical Capacity * (mAh)	Voltage (nom.)	Weight (g)	Diam. (max mm)	Height (max mm)	Length (max mm)	Width (max mm)
NH12		AAA	700	1.2	12	10.5	44.5	N/A	N/A
NH15		AA	1700	1.2	27	14.5	50.5	N/A	N/A
NH22		9V	150	7.2	41	N/A	48.5	26.5	16.9

NH35		C	2200	1.2	60	26.2	50.0	N/A	N/A
NH50		D	2200	1.2	73	34.2	61.5	N/A	N/A

*** Based on a C/5 discharge to 0.9 volts per cell. See datasheets for details.***

Back to Rechargeable Product Offerings Table

HOME

Name	Size	Typical Capacity * (mAh)	Voltage (nom.)	Weight (g)	Height (max mm)	Length (max mm)	Width (max mm)	Chemistry
CP8248	Cellular	1100	4.8	113	101.6	29.3	15.05	Nickel Metal Hydride
NI-1030	Computer	3500	10.8	479	215	52.8	18.8	Nickel Metal Hydride
NI-2020	Computer	4500	10.8	428	149.1	89.1	19.7	Lithium Ion
NJ-1020	Computer	3500	12.0	590	149.4	89.1	19.78	Nickel Metal Hydride
P8400	Cordless	1100	4.8	113	60.8	51.1	17.1	Nickel Metal Hydride

** Based on a C/5 discharge to 0.9 volts per cell. See datasheets for details.*

Eveready Battery Company, Inc.

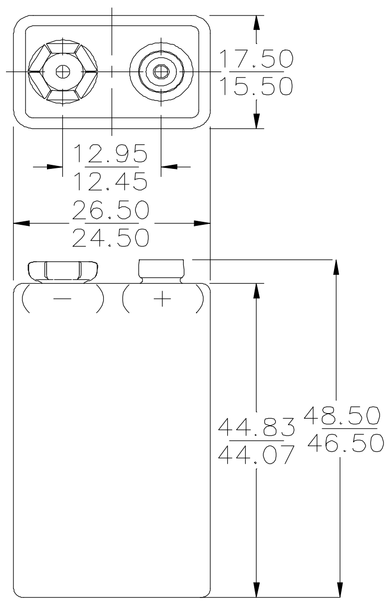
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Alkaline **9V**
No Added Mercury or Cadmium

ENERGIZER e^2 NO. X522

Dimensions (mm)

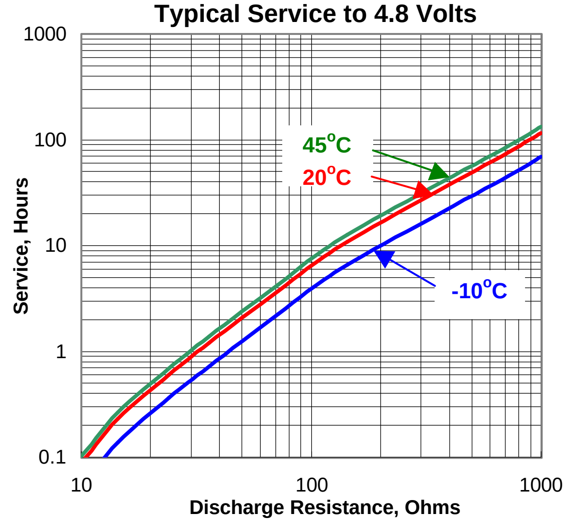


Millimeters	Inches
12.45	0.490
12.95	0.510
15.50	0.610
17.50	0.689
24.50	0.965
26.50	1.043
44.07	1.735
44.83	1.765
46.50	1.831
48.50	1.909

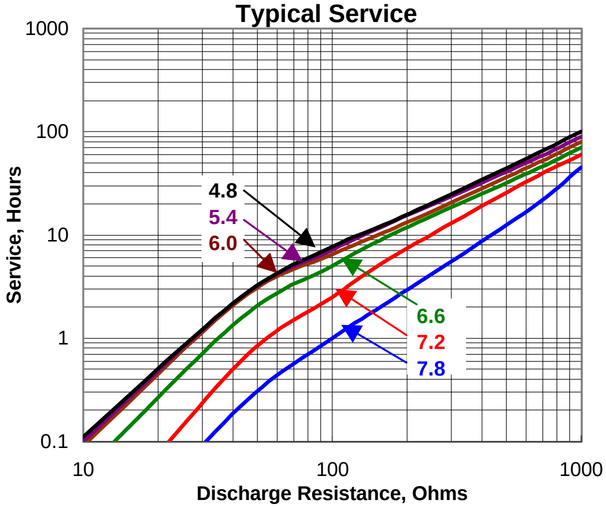
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-1604A, IEC-6LR61
Battery Voltage: 9 Volts
Average Weight: 45.6 grams (1.60 oz.)
Volume: 21.1 cubic centimeters (1.3 cubic inch)
Average Service capacity (to 0.8 Volts / cell): 595 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: Six No. X3-0316 in series
Jacket: Metal
Shelf Life: 5 years

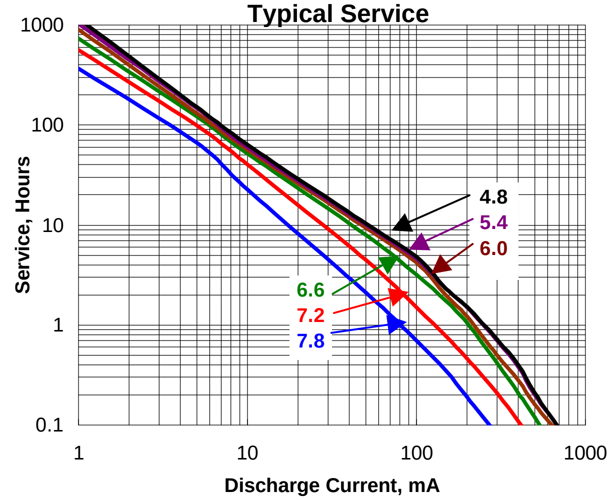
Temperature Effects
Typical Service to 4.8 Volts

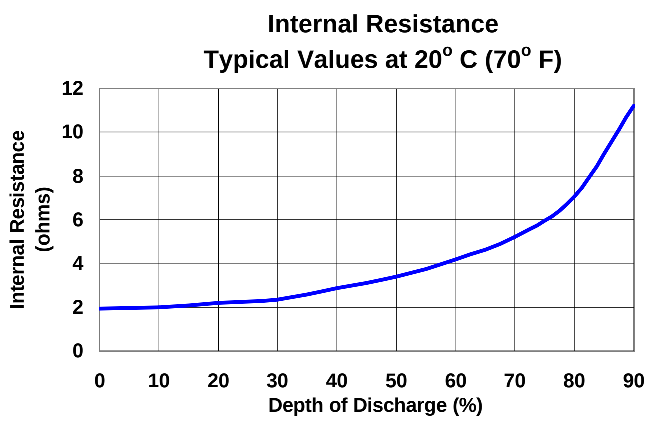


Constant Resistance Discharge
Typical Service

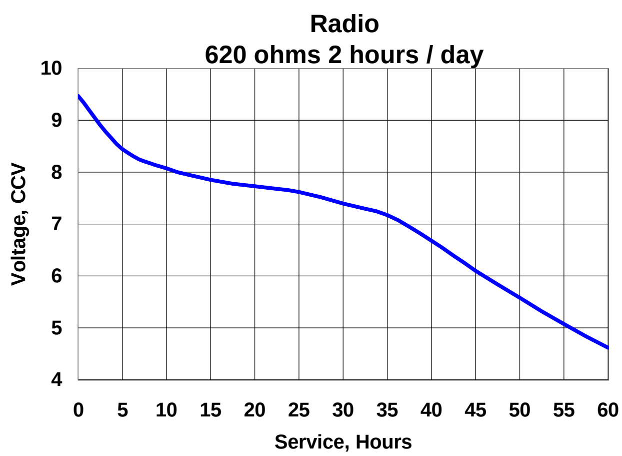


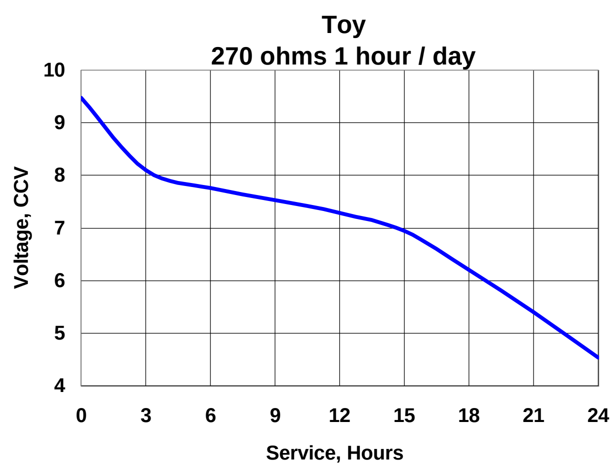
Constant Current Discharge
Typical Service

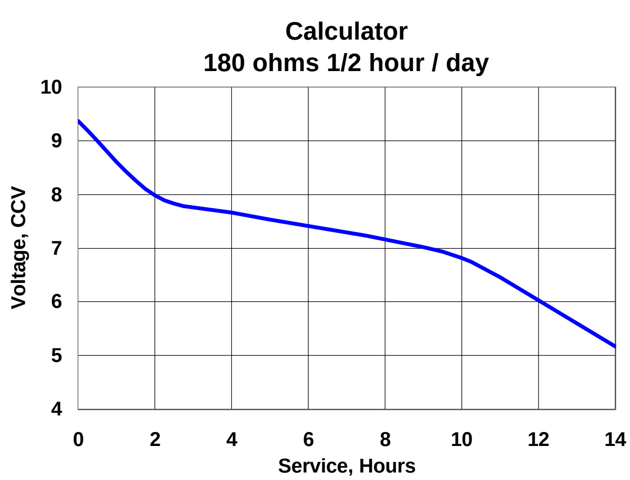




Typical Applications







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Eveready Battery Company, Inc.

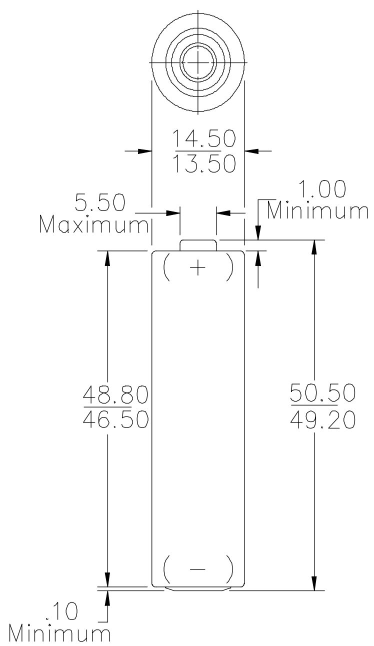
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

AA
Alkaline **1.5V**
No Added Mercury or Cadmium

ENERGIZER NO. X91

Dimensions (mm)

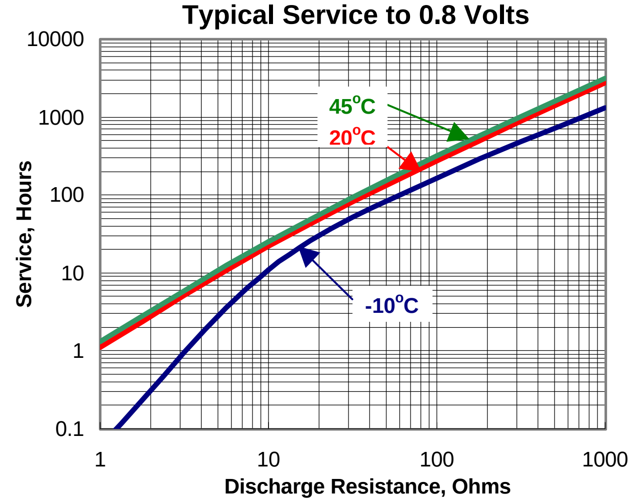


Millimeters	Inches
0.1	0.004
1.0	0.039
5.5	0.217
13.5	0.531
14.5	0.571
46.5	1.831
48.8	1.921
49.2	1.937
50.5	1.988

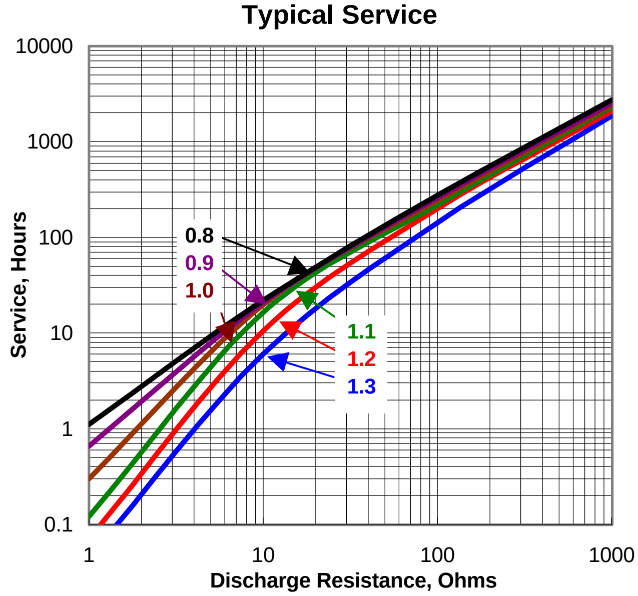
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-15A, IEC-LR6
Battery Voltage: 1.5 Volts
Average Weight: 23 grams (0.8oz.)
Volume: 8.1 cubic centimeters (0.5cubic inch)
Average Service capacity (to 0.8Volts / cell): 3135 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. X3-315 (size "AA")
Jacket: Plastic Label
Shelf Life: 7 years

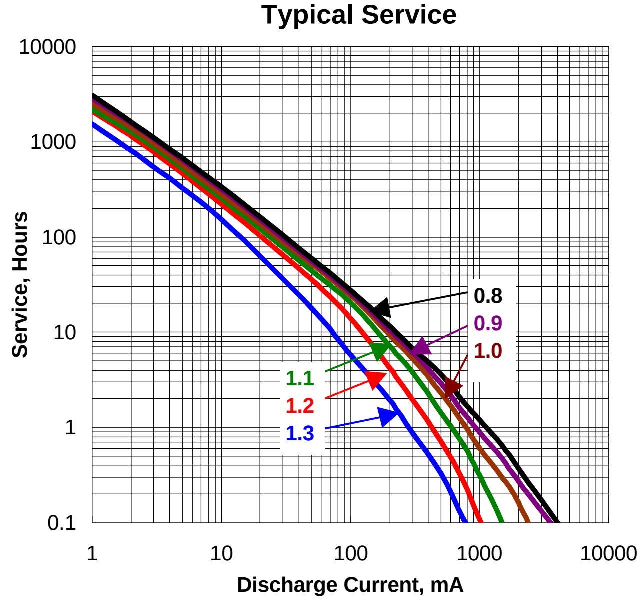
Temperature Effects
Typical Service to 0.8 Volts



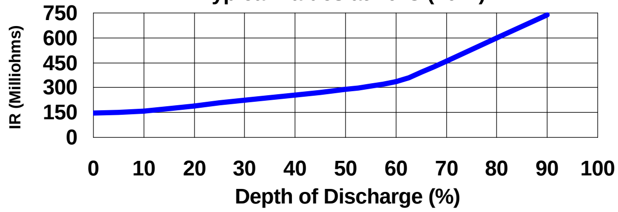
Constant Resistance Discharge
Typical Service



Constant Current Discharge
Typical Service



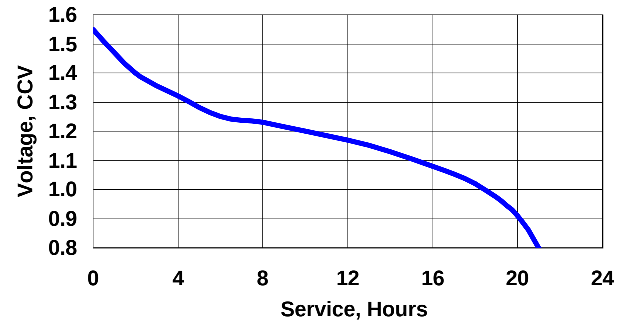
Internal Resistance
Typical Values at 20°C (70°F)



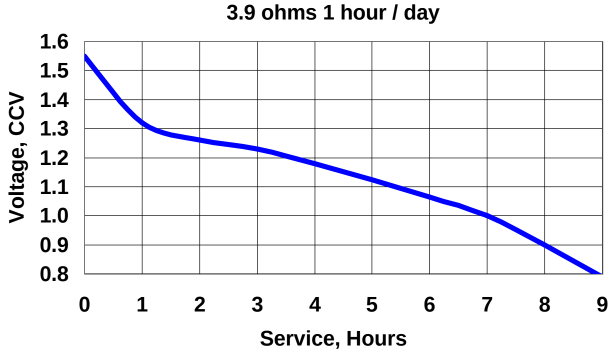
Typical Applications

Radio
43 ohms 4 hours / day

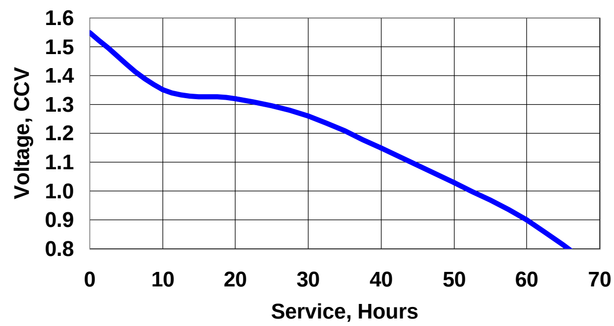
Recorder
10 ohms 1 hour / day



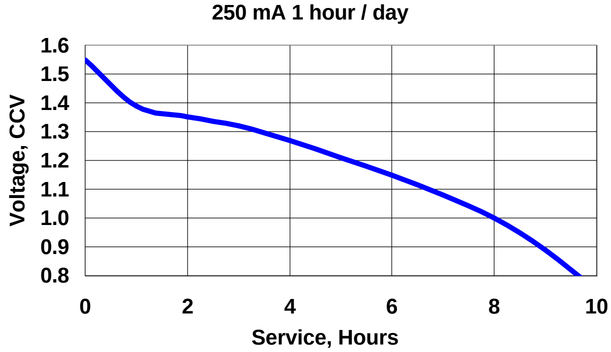
Toy
3.9 ohms 1 hour / day



Remote
24 ohms 15 sec / min - 8 hrs / day

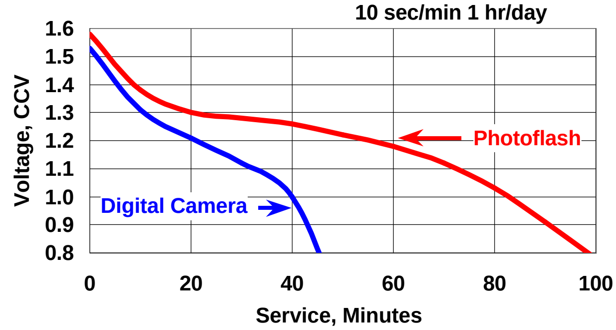


CD / MD / Electronic Game
250 mA 1 hour / day



Digital Camera
1000 mA Cont.

Photo Flash
1000 mA
10 sec/min 1 hr/day



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Eveready Battery Company, Inc.

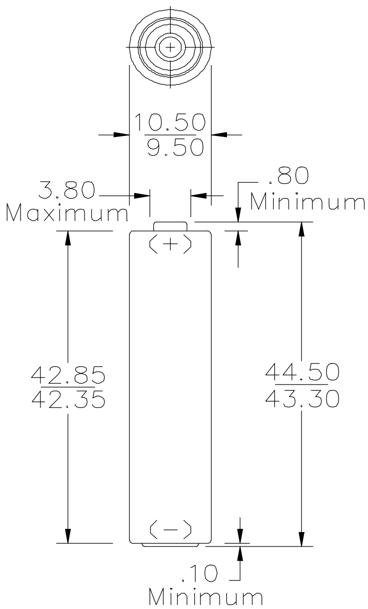
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

AAA
Alkaline **1.5V**
No Added Mercury or Cadmium

ENERGIZER NO. X92

Dimensions (mm)

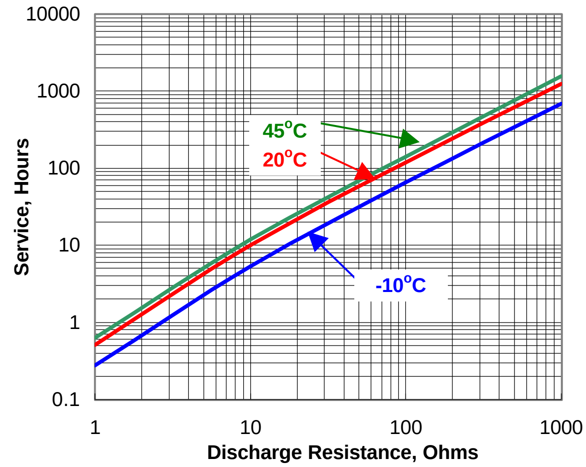


Millimeters	Inches
0.10	0.004
0.80	0.031
3.80	0.15
9.50	0.374
10.50	0.413
42.35	1.667
42.85	1.687
43.30	1.705
44.50	1.752

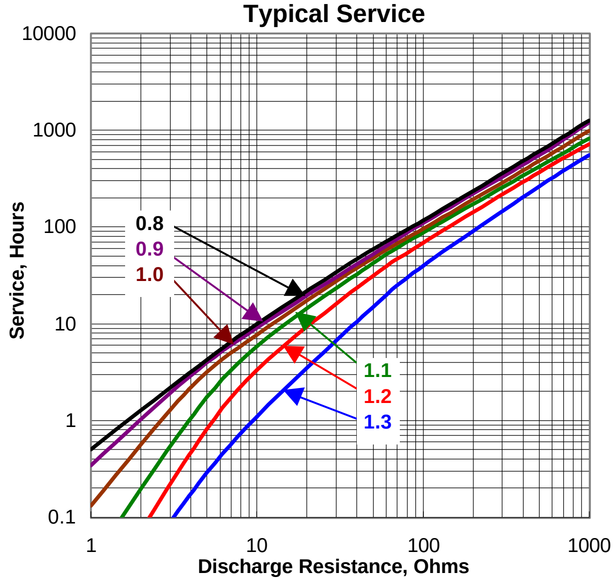
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-24A, IEC-LR03
Battery Voltage: 1.5 Volts
Average Weight: 11.5 grams (0.4 oz.)
Volume: 3.8cubic centimeters (0.2 cubic inch)
Average Service capacity (to 0.8 Volts / cell): 1375 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. X3-312 (size "AAA")
Jacket: Plastic Label
Shelf Life: 7 years

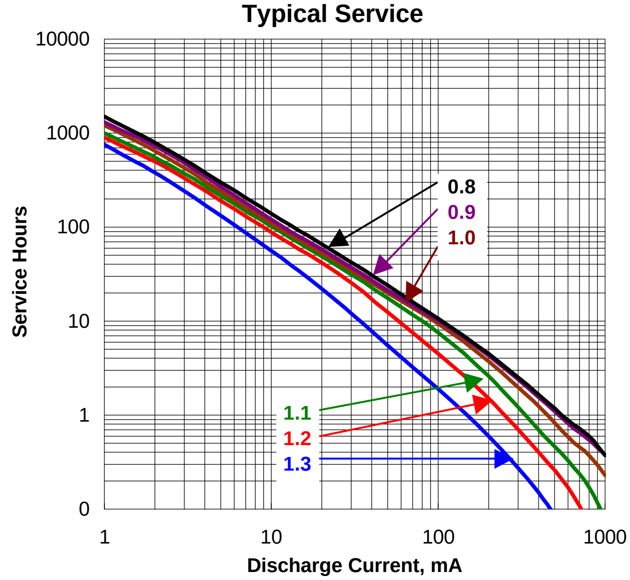
Temperature Effects
Typical Service to 0.8 Volts



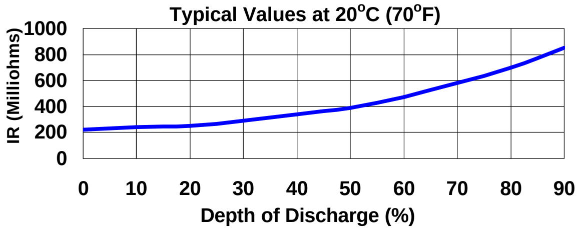
Constant Resistance Discharge
Typical Service



Constant Current Discharge
Typical Service

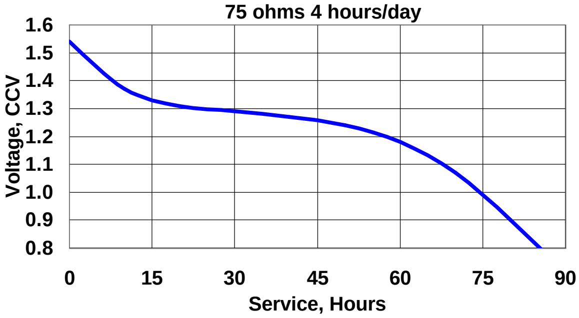


Internal Resistance
Typical Values at 20°C (70°F)

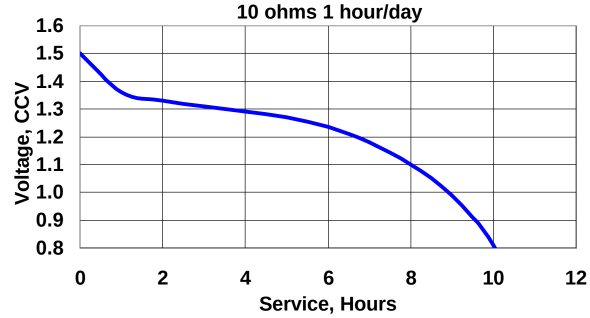


Typical Applications

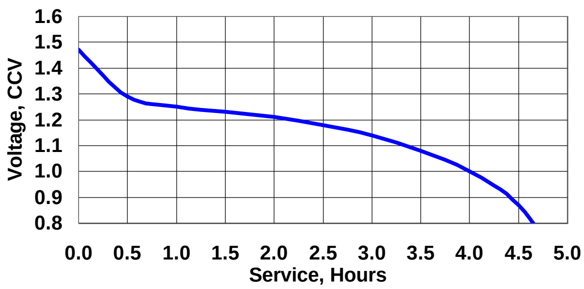
Radio
75 ohms 4 hours/day



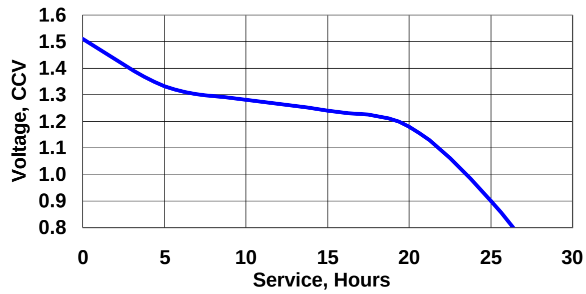
Tape Recorder
10 ohms 1 hour/day



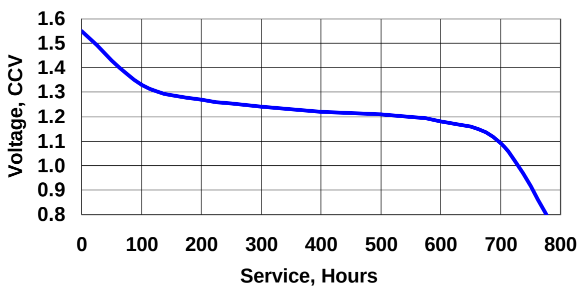
Portable Lighting
5.1 ohms 4 min/hour, 8 hours/day



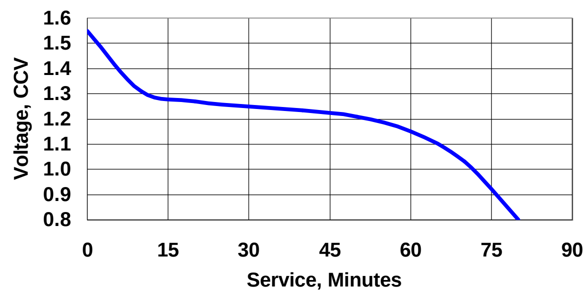
Remote
24 ohms 15 seconds/day 24 hours/day



Pager
1.2 mA Background
120 mA 10 sec/hr 24 hours/day



Photoflash
600 mA 10 sec/min
1 hour/day



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Eveready Battery Company, Inc.

533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

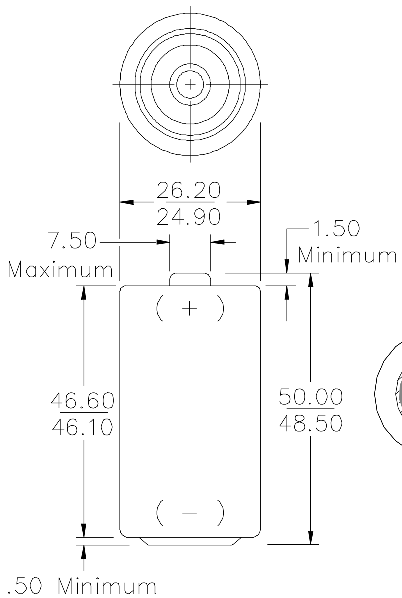
Engineering Data

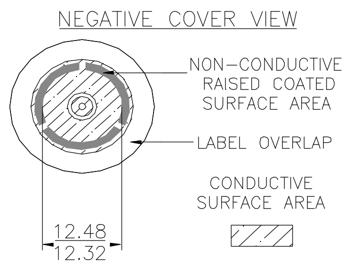
C
Alkaline **1.5V**
No Added Mercury or Cadmium

ENERGIZER NO. X93

Dimensions (mm)

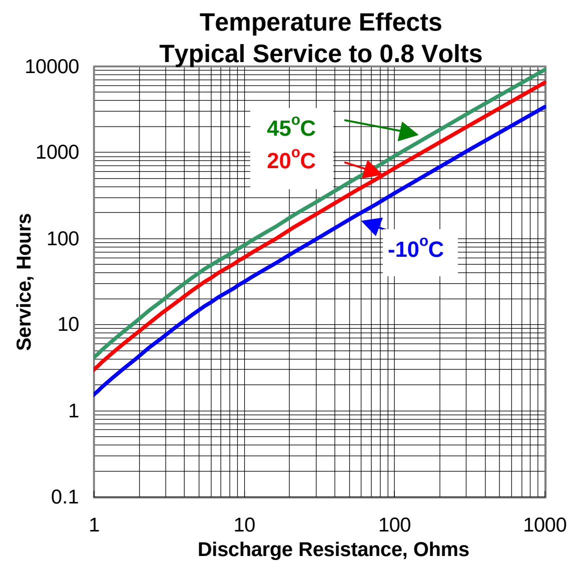
Millimeters	Inches
0.50	0.020
1.50	0.059
7.50	0.295
12.32	0.485
12.48	0.491
24.90	0.980
26.20	1.031
46.10	1.815
46.60	1.835
48.50	1.909
50.00	1.969

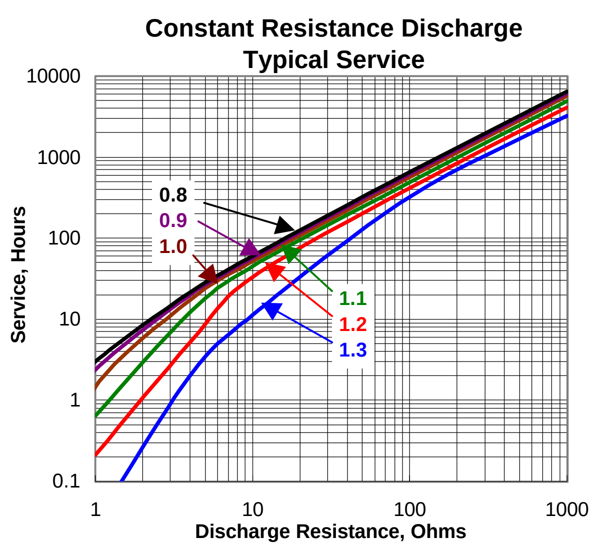


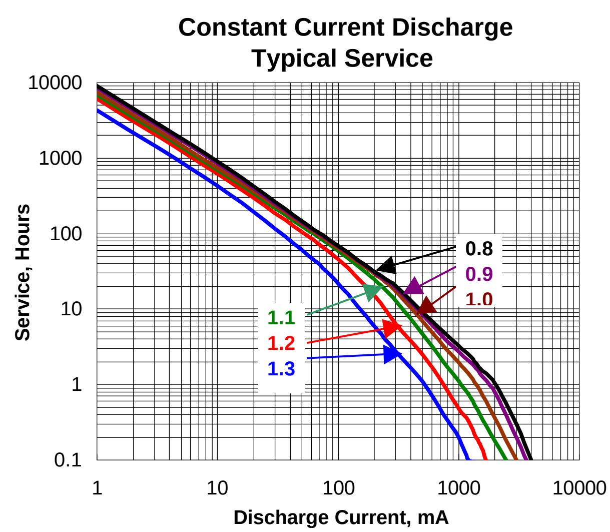


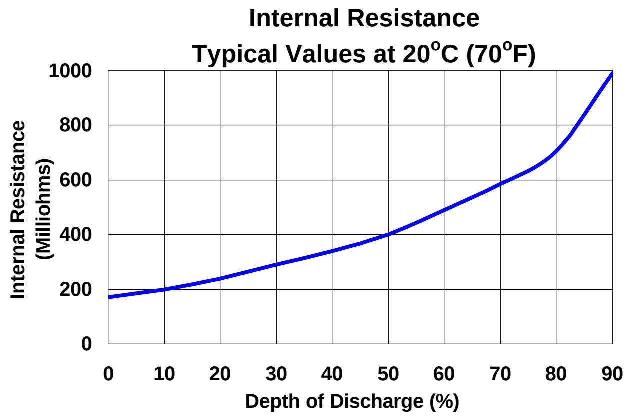
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

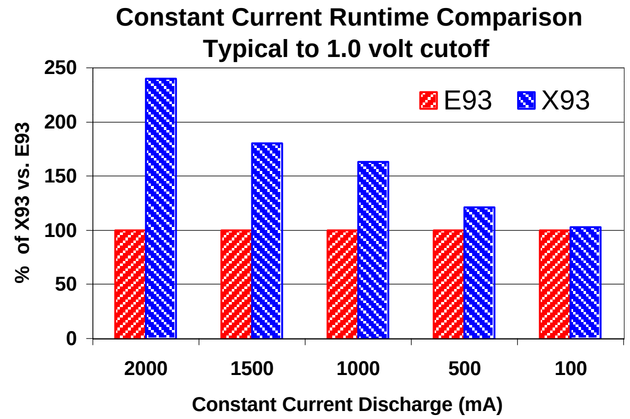
Designation: ANSI-14A, IEC-LR14
Battery Voltage: 1.5 Volts
Average Weight: 66.2 grams (2.3 oz.)
Volume: 26.9 cubic centimeters (1.6 cubic inch)
Average Service capacity (to 0.8 Volts / cell): 8350 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. X3-335 (size "C")
Jacket: Plastic Label
Shelf Life: 7 years



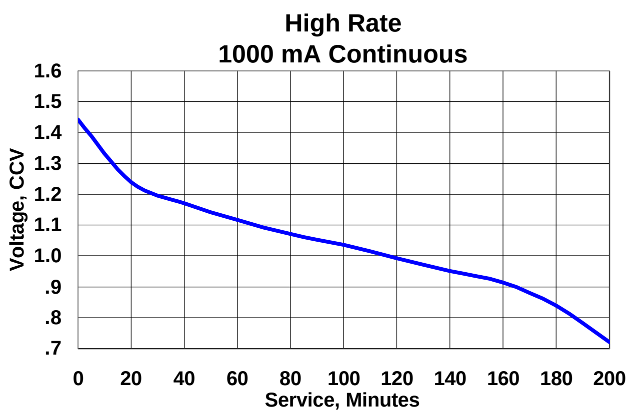


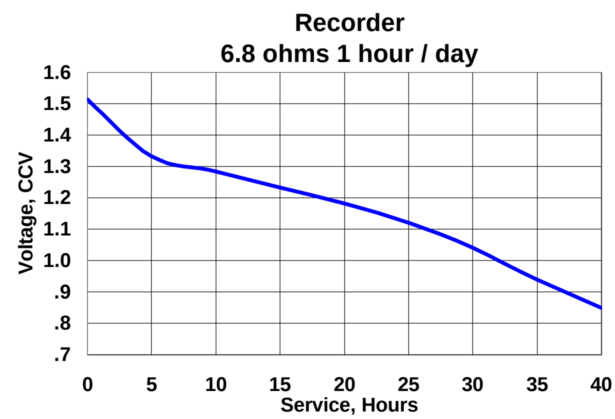


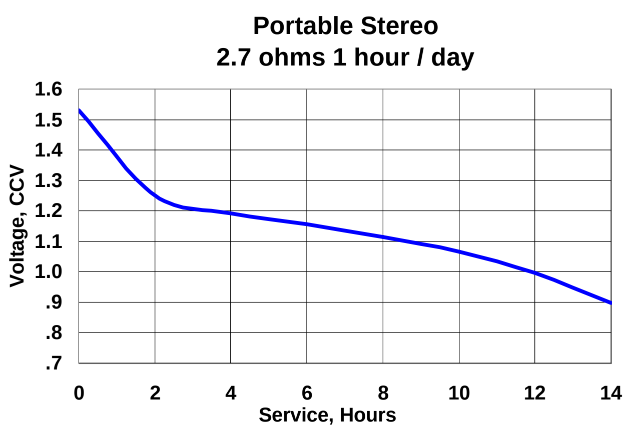


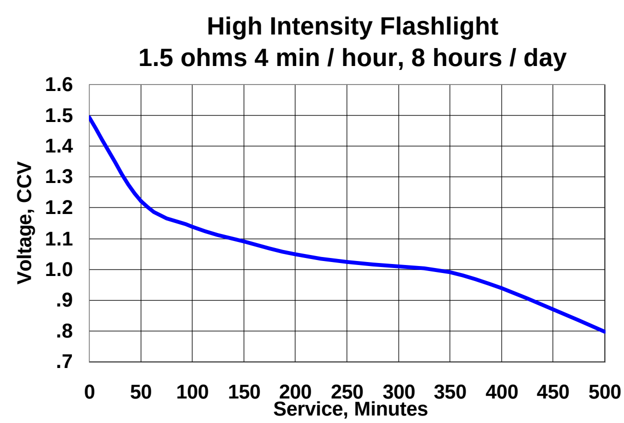


Typical Applications









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Eveready Battery Company, Inc.

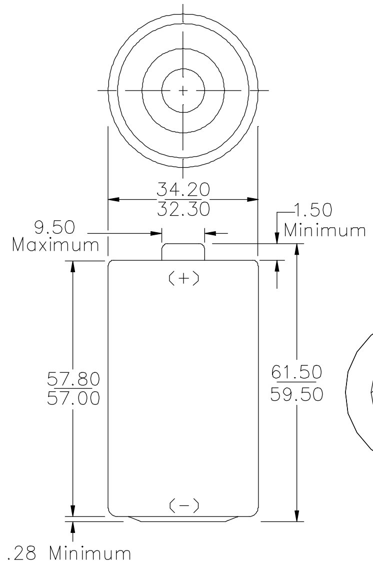
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

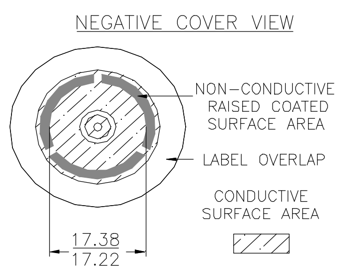
D
Alkaline **1.5V**
No Added Mercury or Cadmium

ENERGIZER e² NO. X95

Dimensions (mm)



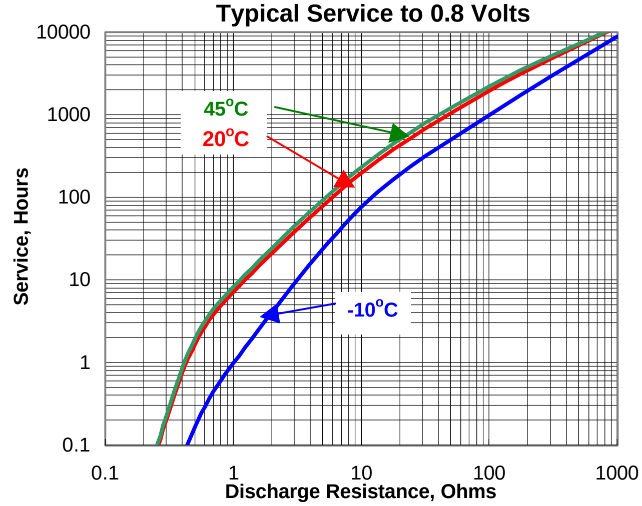
Millimeters	Inches
0.28	0.011
1.50	0.059
9.50	0.374
17.22	0.678
17.38	0.684
32.30	1.272
34.20	1.346
57.00	2.244
57.80	2.276
59.50	2.343
61.50	2.421



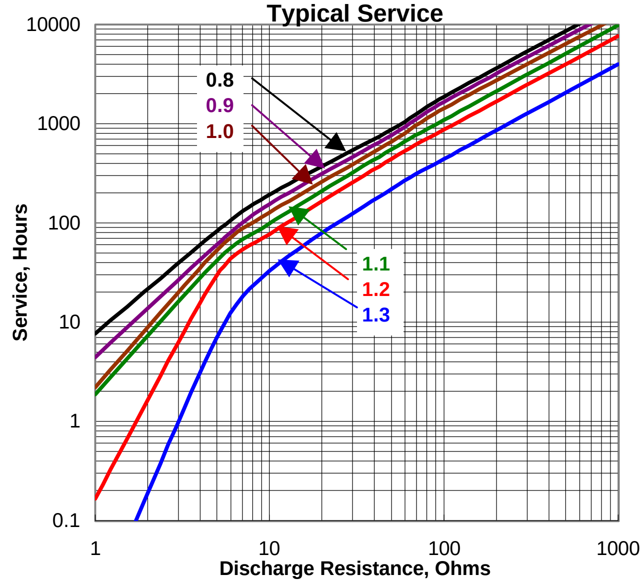
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-13A, IEC-LR20
Battery Voltage: 1.5 Volts
Average Weight: 141.9 grams (5.0 oz.)
Volume: 55.9 cubic centimeters (3.4 cubic inch)
Average Service capacity (to 0.8 Volts / cell): 18000 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. X3-350 (size "D")
Jacket: Plastic Label
Shelf Life: 7 years

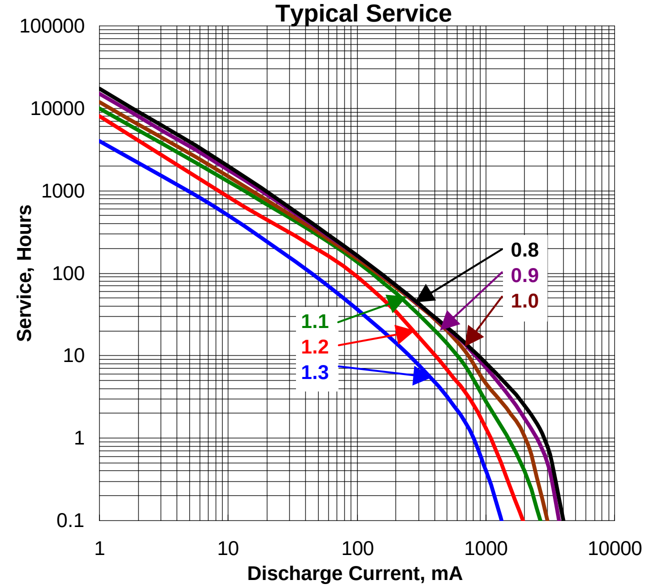
Temperature Effects
Typical Service to 0.8 Volts

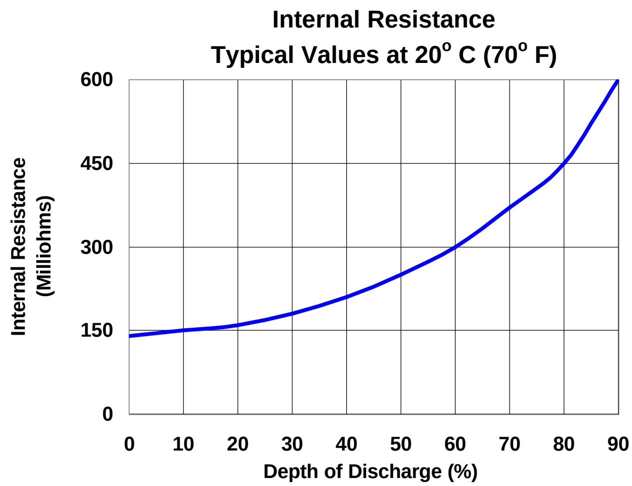


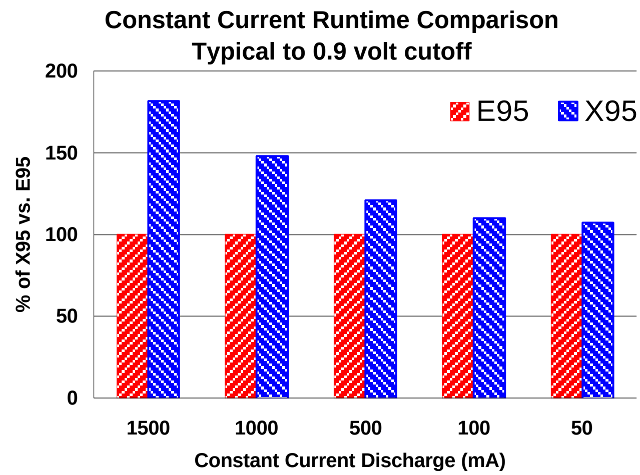
Constant Resistance Discharge
Typical Service



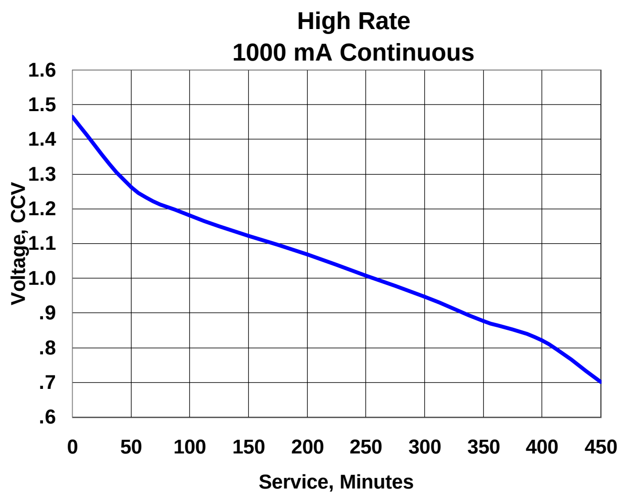
Constant Current Discharge
Typical Service

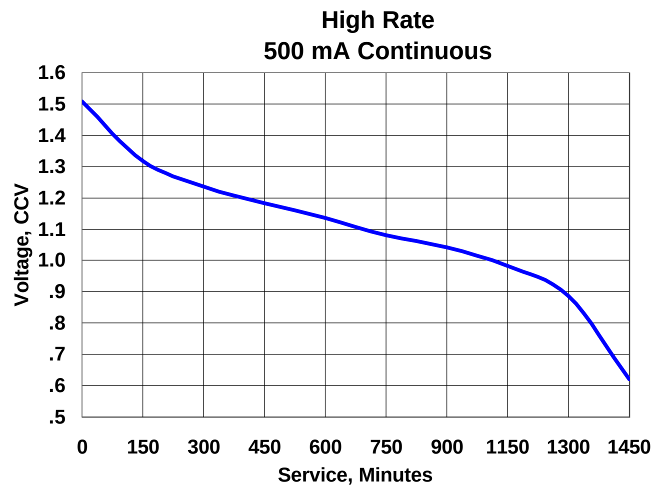


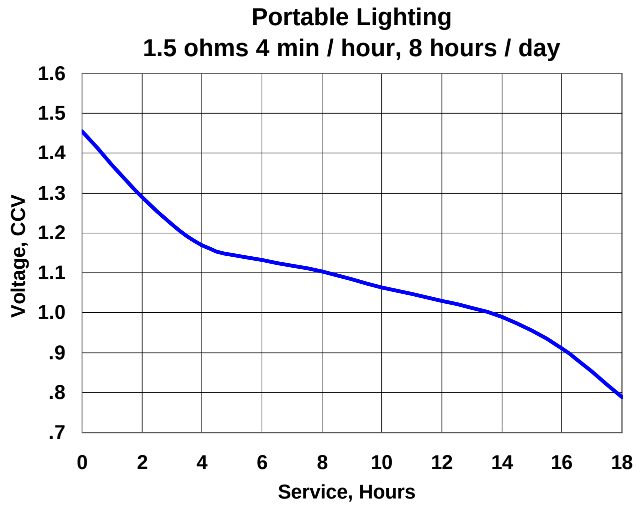


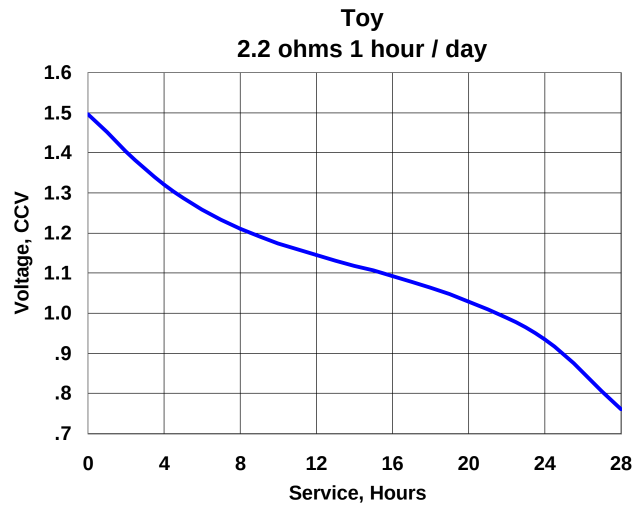


Typical Applications









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Eveready Battery Company, Inc.

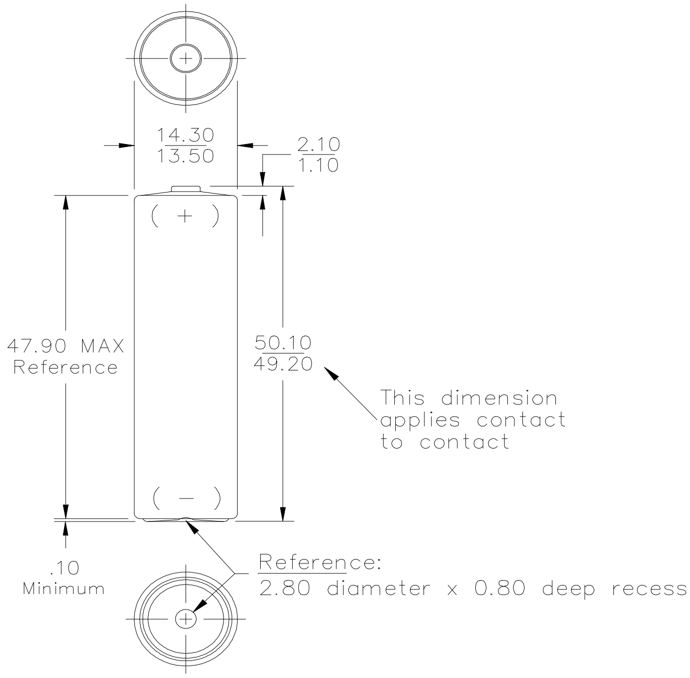
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Zinc Chloride ***1.5V***
Super Heavy Duty
No Added Mercury or Cadmium

EVEREADY NO. 1215

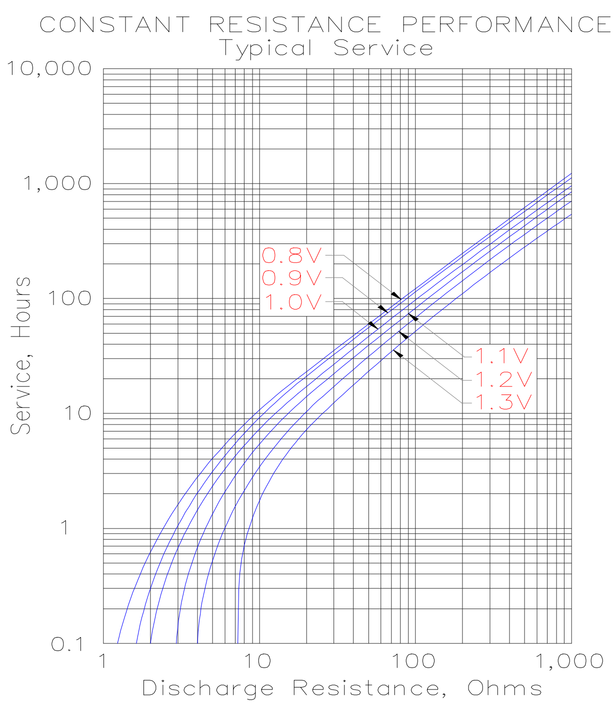
Dimensions (mm)

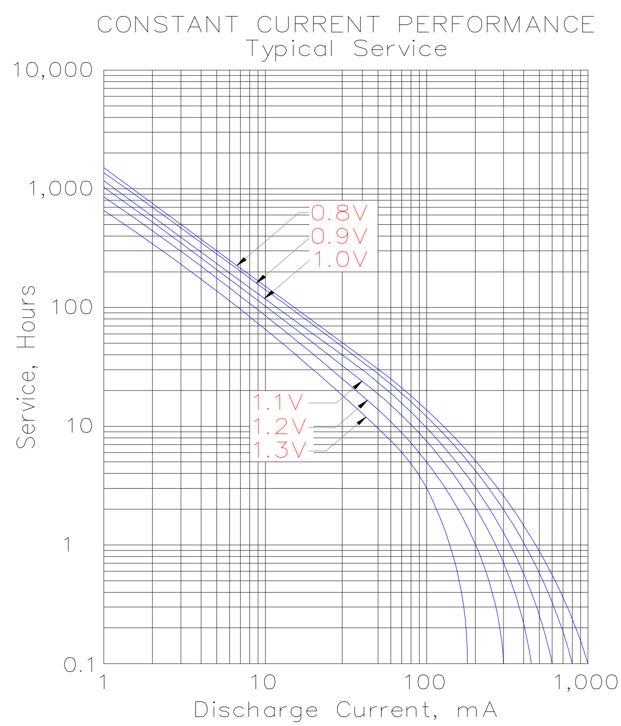


Chemical System:Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-15D, IEC-R6
Battery Voltage: 1.5 Volts
Average Weight: 15 grams (0.5 oz.)
Volume: 8.0 cubic centimeters (0.5 cubic inch)
Average Service capacity (to 0.8 Volts): 950 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 15 (size “AA”)
Jacket: Plastic Laminated Paper

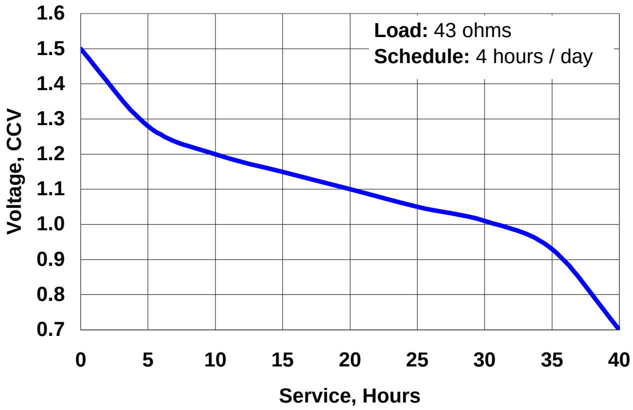
Millimeters	Inches
0.10	0.004
0.80	0.031
1.10	0.043
2.10	0.083
2.80	0.110
13.50	0.531
14.30	0.563
47.90	1.886
49.20	1.937
50.10	1.972



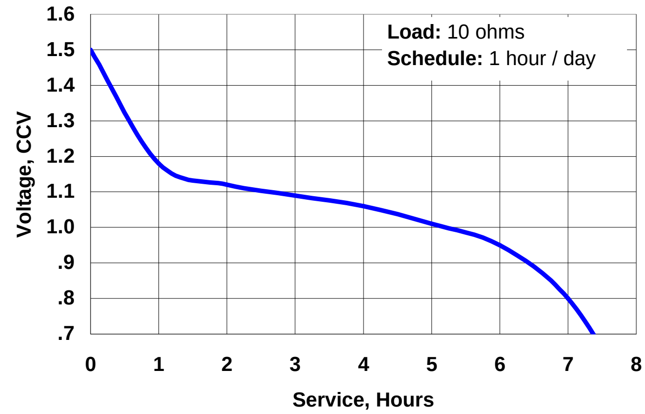


Typical Applications

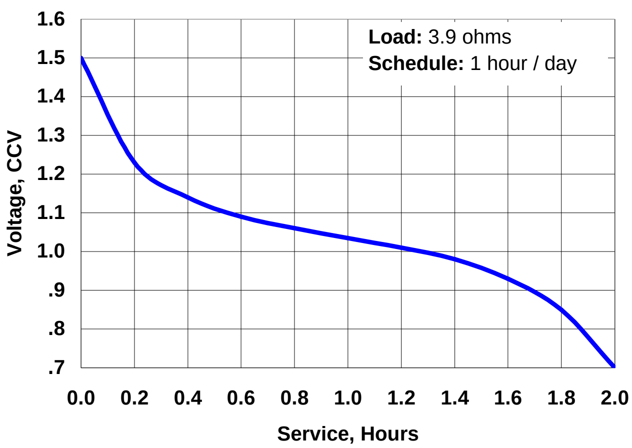
Radio



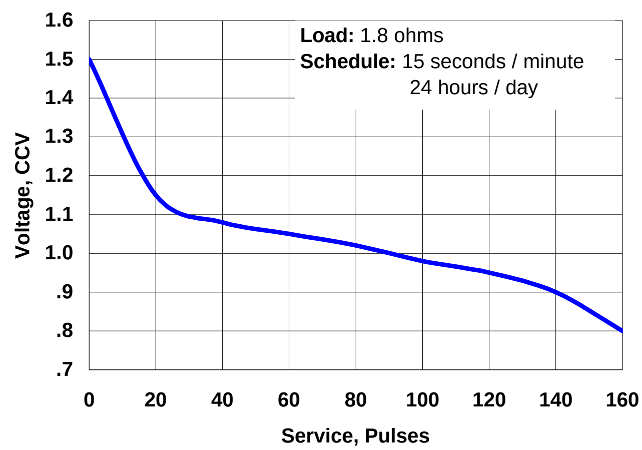
Recorder



Toy



Pulse Test



INTERNAL RESISTANCE VS. TEMPERATURE
This measurement is an approximation of the battery's actual internal resistance. It is sensitive to the loads and operator technique.

Schedule: Background Load 750 ohms.
Pulse Load 4.0 ohms.
Pulse Duration 1 second

Temperature	Typical Ri (ohms)
45ºC (113ºF)	0.4
21ºC (70ºF)	0.5
0ºC (32ºF)	0.8
-21ºC (-4ºF)	5.0

Important Notice

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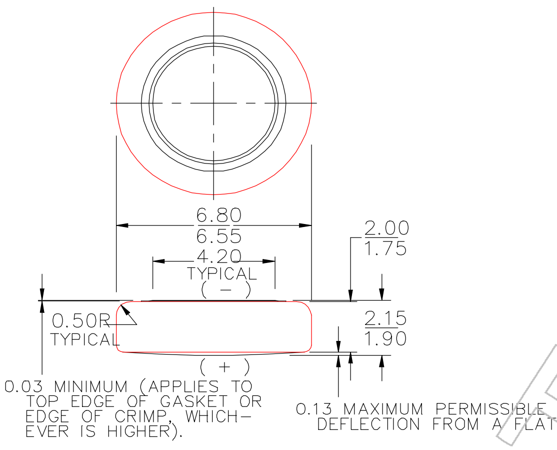
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 164



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: N/A
Average Service Capacity (to 1.2 volts): 24 mAh
(Rated capacity at 45,000 ohms @ 21^{o}C)
Typical Weight: 0.36 grams (0.013 oz.)
Terminals: Flat Contact
Volume: 0.08 cubic centimeters (0.005 cubic in.)

Dimensions (mm)

Millimeters	Inches
0.03	0.001
0.13	0.005
0.50	0.020
1.75	0.069
1.90	0.075
2.00	0.079
2.15	0.085
4.20	0.165
6.55	0.258
6.80	0.268

IMPORTANT NOTICE

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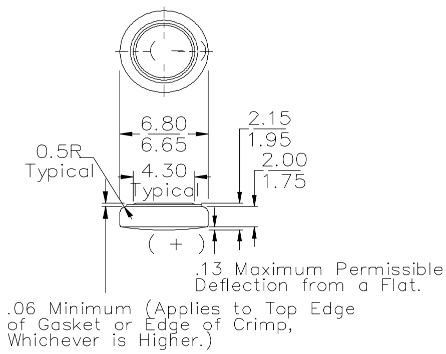
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 364

Dimensions (mm)



Millimeters	Inches
0.06	0.002
0.13	0.005
0.50	0.020
1.75	0.069
1.95	0.077
2.00	0.079
2.15	0.085
4.30	0.169
6.65	0.262
6.80	0.268

Chemical System: Silver Oxide (Zn/Ag_2O)

Designation: ANSI / NEDA-1175SO, IEC-SR60/TR60
Battery Voltage: 1.55 Volts
Average Weight: .31 grams (0.11 oz.)
Volume: 0.08 cubic centimeters (0.005 cubic inch)
Average Service capacity (to 1.3 Volt): 20 mAh
(Rated Capacity at 70k ohms continuous at 21°C)

Designed For Use On Continuous Low Drain

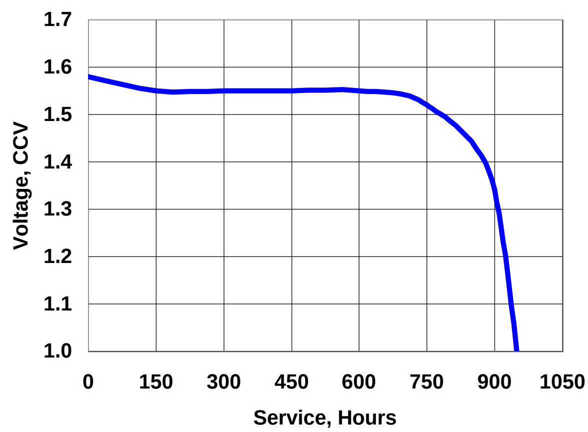
Simulated Application Tests
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	Cutoff Voltage 1.3V
			hours
24 hours / day	**0.022**	**70,000**	**915**

Internal Resistance Closed circuit voltage no less than 0.85 volts on a load of 100 ohms at 21°C (70°F) for 0.1 to 2.0 seconds.

Typical closed circuit voltage during discharge on a load of 2,000 ohms for 0.0078 seconds.

Typical Discharge Characteristics



Depth of Discharge as Percent of Rated Capacity

Temperature	0%	40%	80%
21°C (70°F)	1.58V	1.55V	1.55V
-10°C (70°F)	1.48V	1.38V	1.38V

Important Notice

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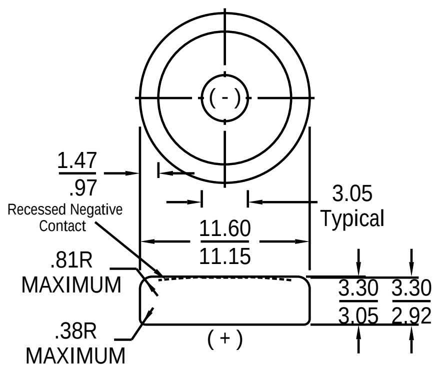
Form No. EBC - 4322B

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 201

Dimensions (mm)

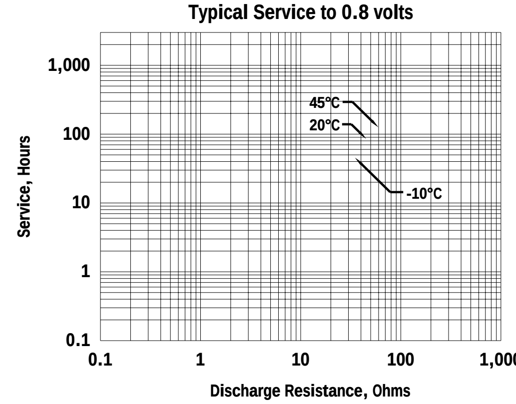


Millimeters	Inches
.38	.015
.81	.032
.97	.038
1.47	.058
2.92	.115
3.05	.120
3.30	.130
11.15	.439
11.30	.445

Chemical System: Silver Oxide (Zn/$Ag_2$0)

Designation: Not Yet Available
Battery Voltage: 1.5 Volts
Average Weight: 1.5 grams (.053 oz.)
Volume: .31 cubic centimeters (.019 cubic inch)
Average Service Capacity (to 1.3 Volt): 53 mAh
(Rated capacity at 20K ohms continuous at 21°C)
Cell: 395

TEMPERATURE EFFECTS
Typical Service to 0.8 volts

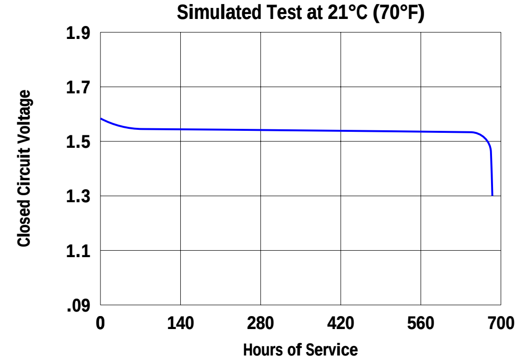


DESIGNED FOR USE ON CONTINUOUS LOW DRAIN

SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 1.3V hours
24 hours / day	77.5	20,000	695

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°F)



INTERNAL RESISTANCE Closed circuit voltage no less than 1.10 volts on a load of 100 ohms at 21°C (70°F) for 0.1 to 2.0 seconds.

Typical closed circuit voltage during discharge on a load of 2,000 ohms for 0.0078 seconds

Depth of Discharge as Percent of Rated Capacity

Temperature	0%	40%	80%
21°C (70°F)	1.58V	1.56V	1.56V
-10°C (14°F)	1.55V	1.45V	1.46V

IMPORTANT NOTICE

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Form No. EPS -

Energizer

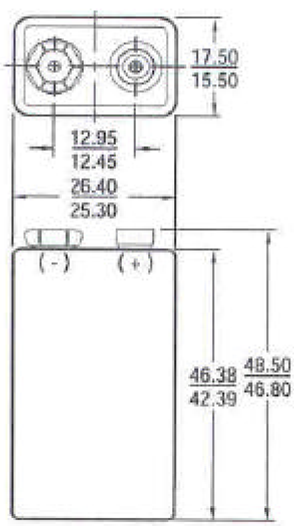
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

EVEREADY NO. 216

LeClanche ***9V***
Classic
No Added Mercury or Cadmium

Dimensions (mm)

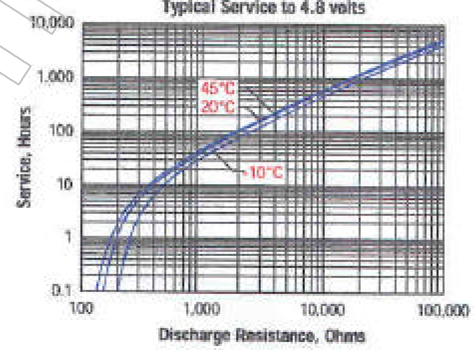


Millimeters	Inches
12.45	.490
12.95	.510
15.50	.610
17.50	.689
25.30	.996
26.40	1.039
42.39	1.669
46.38	1.826
46.80	1.843
48.50	1.909

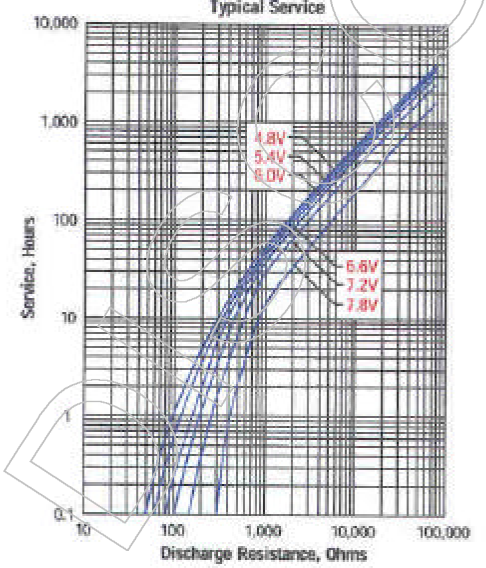
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-1604, IEC-6F22
Battery Voltage: 9 Volts
Average Weight: 36 grams (1.3 oz.)
Volume: 22.4 cubic centimeters (1.4 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 200 mAh
(Rated capacity at 25 mA continuous drain)
Cells: Six No. 118P in series
Jacket: Metal

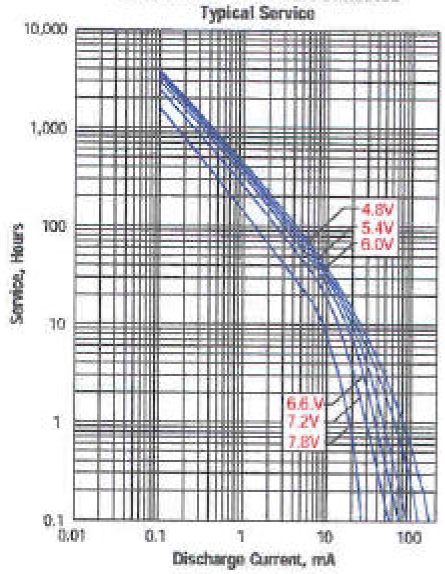
TEMPERATURE EFFECTS
Typical Service to 4.8 volts



CONSTANT RESISTANCE PERFORMANCE
Typical Service



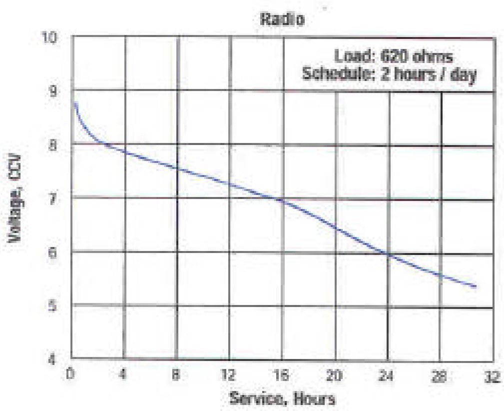
CONSTANT CURRENT PERFORMANCE
Typical Service

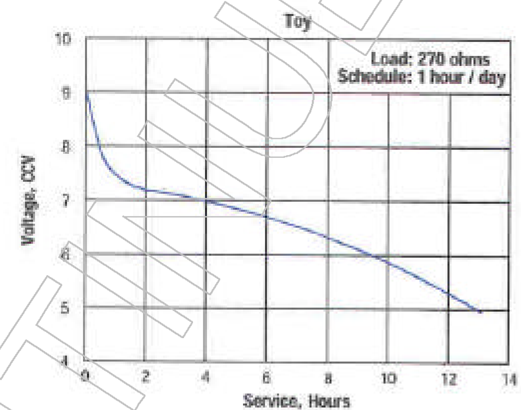


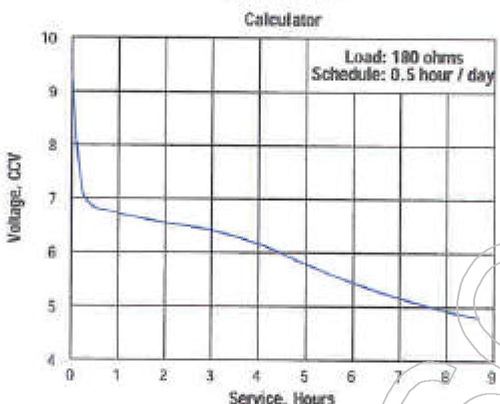
Form No. EPS - 3104C

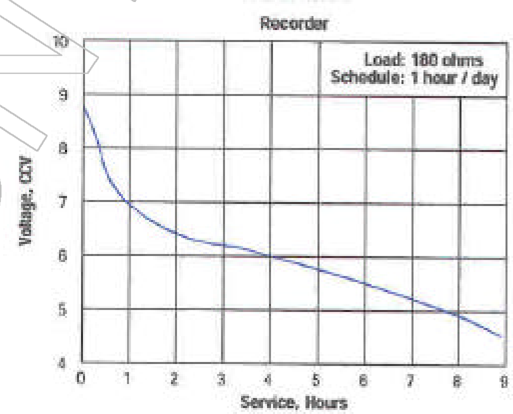
EVEREADY NO. 216

TYPICAL APPLICATIONS









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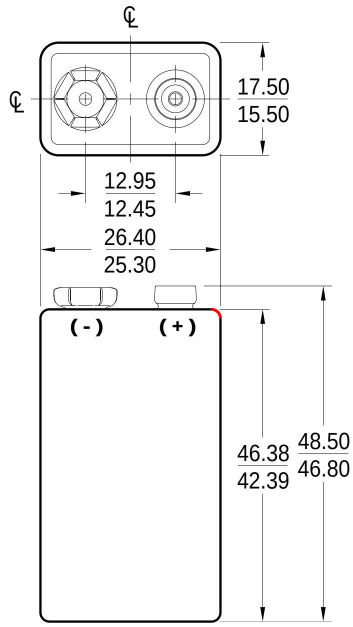
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

LeClanche ***9V***
Super Heavy Duty
No Added Mercury or Cadmium

EVEREADY NO. 1222

Dimensions (mm)

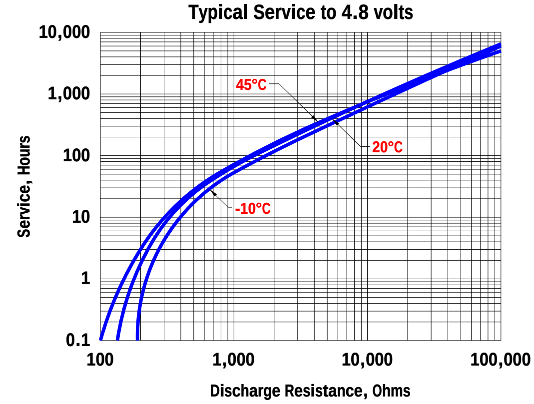


Millimeters	Inches
12.45	.490
12.95	.510
15.50	.610
17.50	.689
25.30	.996
26.40	1.039
42.39	1.669
46.38	1.826
46.80	1.843
48.50	1.909

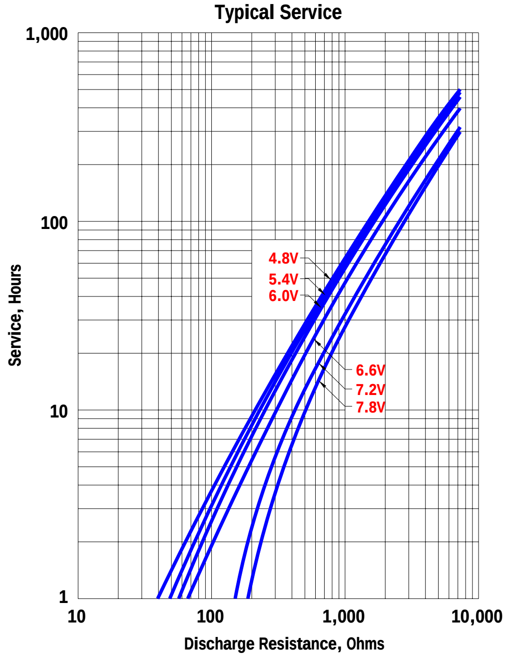
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-1604D, IEC-6F22
Battery Voltage: 9 Volts
Average Weight: 37 grams (1.3 oz.)
Volume: 20.3 cubic centimeters (1.2 cubic inch)
Cells: Six No. 118P in series
Jacket: Metal

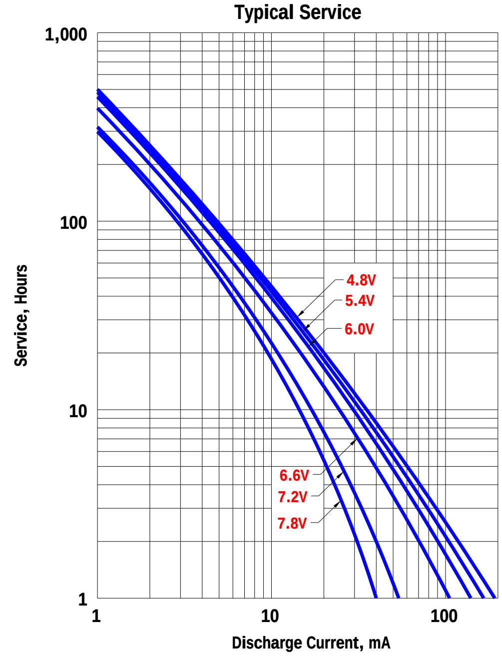
TEMPERATURE EFFECTS
Typical Service to 4.8 volts



CONSTANT RESISTANCE PERFORMANCE
Typical Service



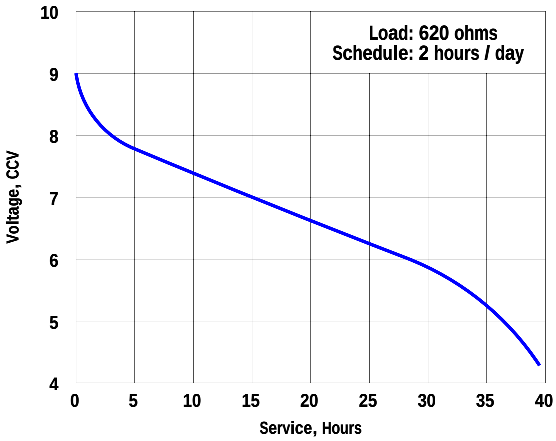
CONSTANT CURRENT PERFORMANCE
Typical Service



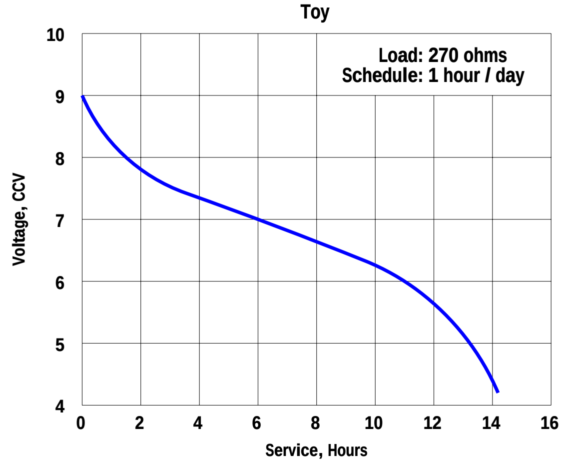
Form No. EPS - 3112B

TYPICAL APPLICATIONS

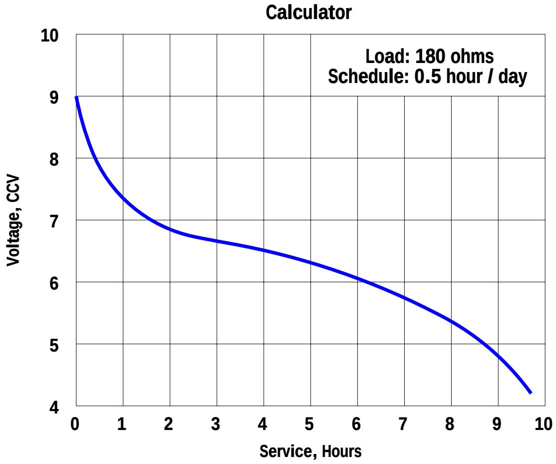
Radio



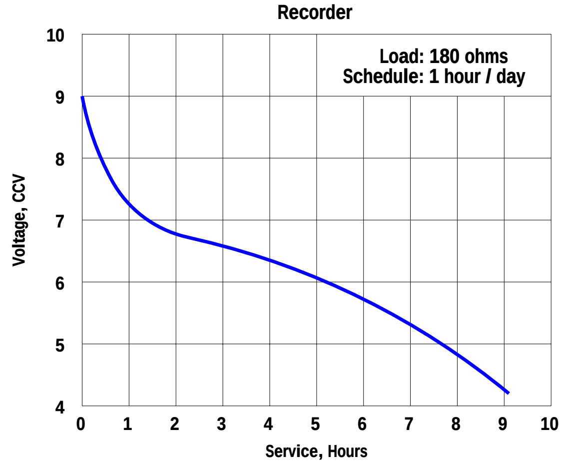
Toy



Calculator



Recorder



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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

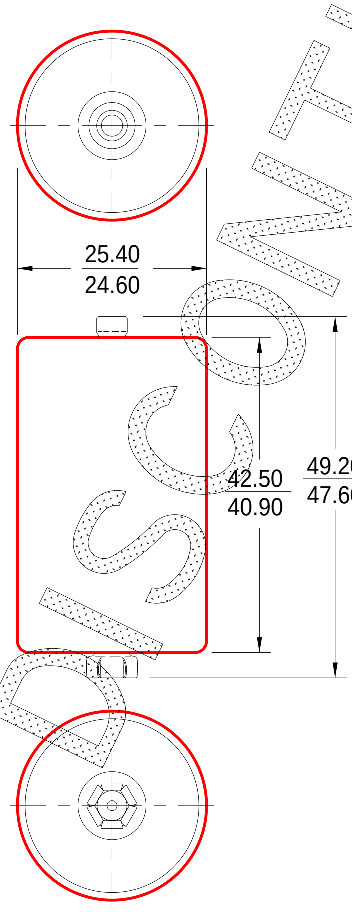
EVEREADY NO. 226

LeClanche ***9V***
No Added Mercury or Cadmium

Chemical System: LeClanche-Manganese Dioxide ($Zn/Mn0_2$)

Designation: ANSI / NEDA-1600, IEC-6F24
Battery Voltage: 9 Volts
Average Weight: 45 grams (1.6 oz.)
Volume: 22 cubic centimeters (1.3 cubic inch)
Cells: Six No. 127 in series.
Jacket: Metal

Dimensions (mm)



Millimeters	Inches
24.60	.969
25.40	1.000
40.90	1.610
42.50	1.673
47.60	1.874
49.20	1.937

Eveready Battery Company, Inc.

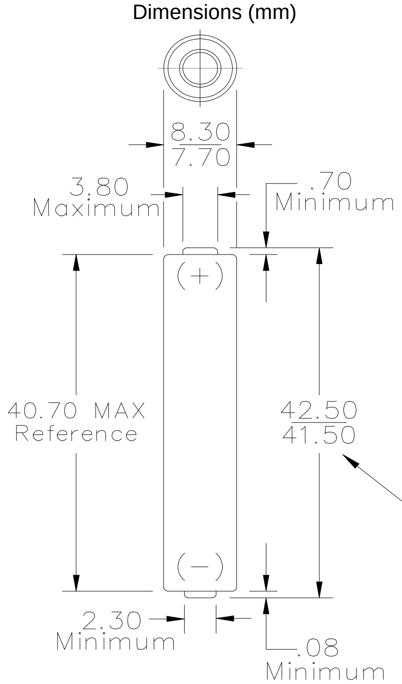
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

AAAA
Alkaline **1.5V**
No Added Mercury or Cadmium

ENERGIZER NO. E96

Dimensions (mm)

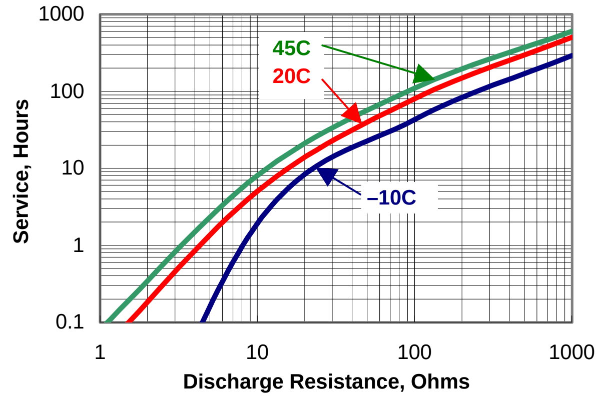


Millimeters	Inches
0.08	0.003
0.70	0.028
2.30	0.091
3.80	0.150
7.70	0.303
8.30	0.327
40.70	1.602
41.50	1.634
42.50	1.673

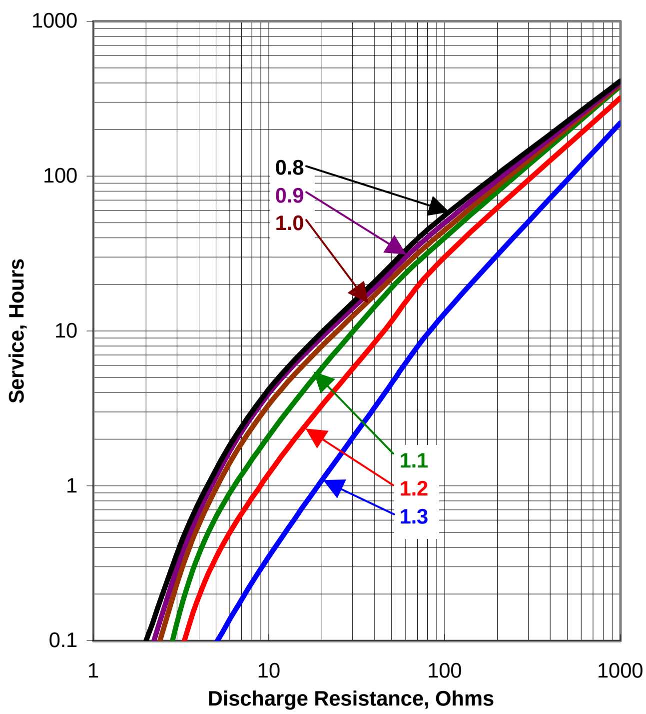
Chemical System:Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-25A
Battery Voltage: 1.5 Volts
Average Weight: 6.5 grams (0.2 oz.)
Volume: 2.2 cubic centimeters (0.1cubic inch)
Average Service capacity (to 0.8Volts / cell): 595 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 3-0316 (size "AAAA")
Jacket: Plastic Label

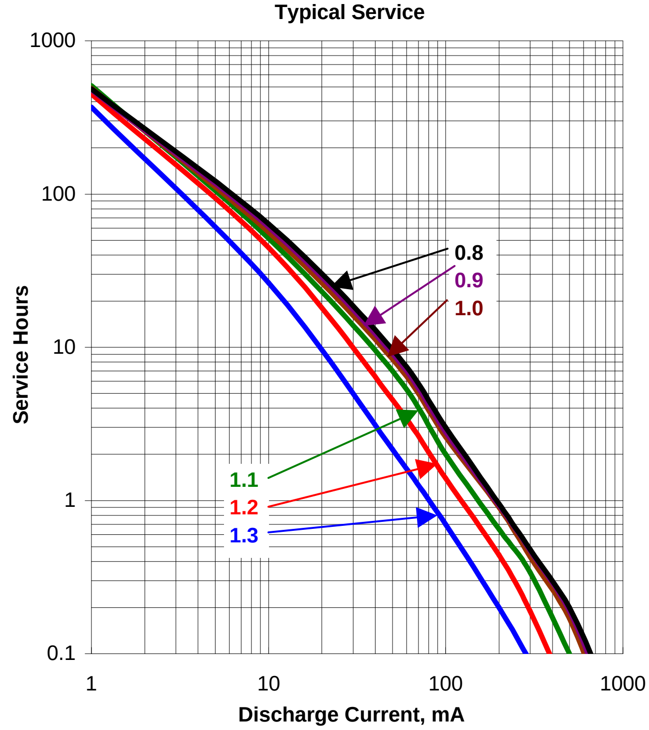
TEMPERATURE EFFECTS
Typical Service to 0.8 Volts



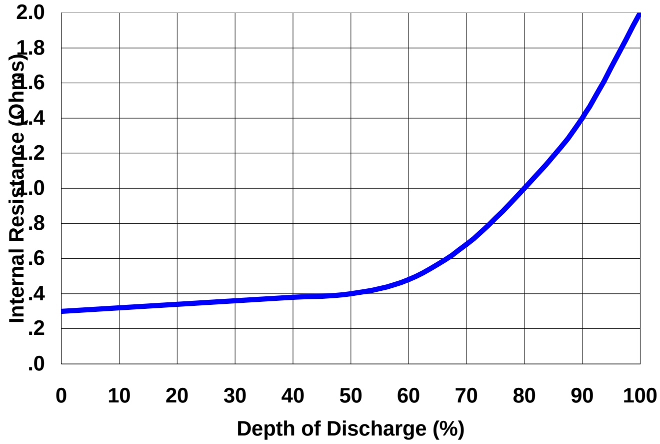
CONSTANT RESISTANCE PERFORMANCE
Typical Service



CONSTANT CURRENT PERFORMANCE
Typical Service

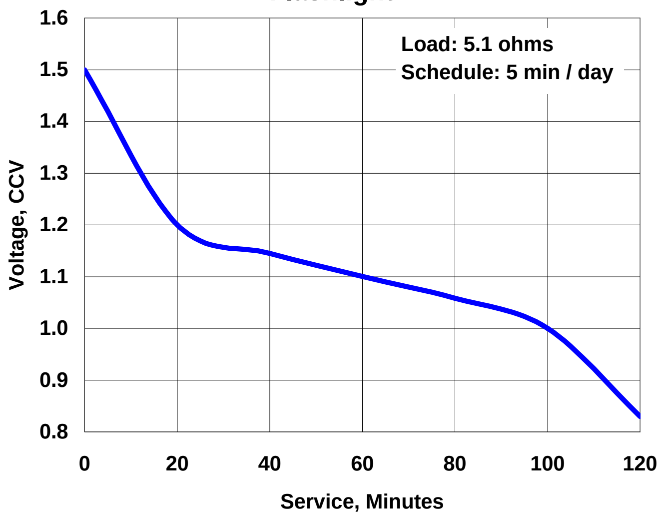


Internal Resistance
Typical Values at 20ºC (70ºF)

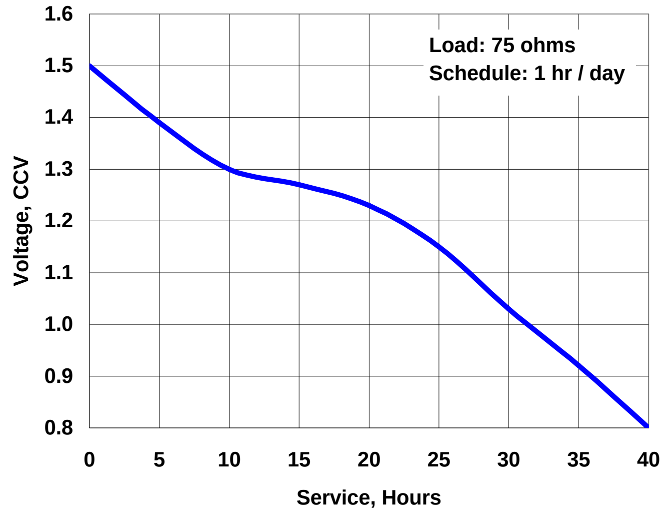


Typical Applications

Flashlight



Radio



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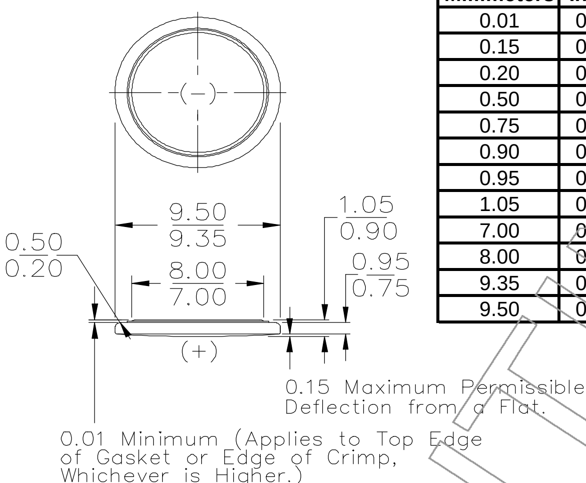
Eveready Battery Company, Inc.

533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 311

Dimensions (mm)

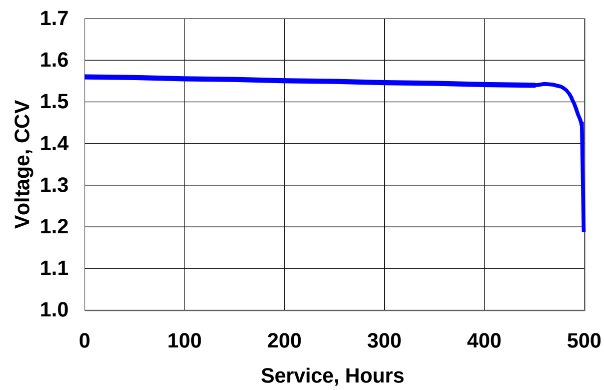


Millimeters	Inches
0.01	0.000
0.15	0.006
0.20	0.008
0.50	0.020
0.75	0.030
0.90	0.035
0.95	0.037
1.05	0.041
7.00	0.276
8.00	0.315
9.35	0.368
9.50	0.374

Chemical System: Silver Oxide (Zn/Ag_2O)

Designation: ANSI / NEDA-Not Yet Available
Battery Voltage: 1.55 Volts
Average Weight: 0.32 grams (0.011 oz.)
Volume: 0.074 cubic centimeters (0.005 cubic inch)
Average Service capacity (to 1.3 Volt): 10.5 mAh
(Rated Capacity at 70k ohms continuous at 21°C)

Typical Discharge Characteristics
Simulated Test at 21ºC (70ºF)



DESIGNED FOR USE ON CONTINUOUS LOW DRAIN

Simulated Application Tests
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	Cutoff Voltage 1.3V hours
24 hours / day	0.22	70,000	499

Important Notice

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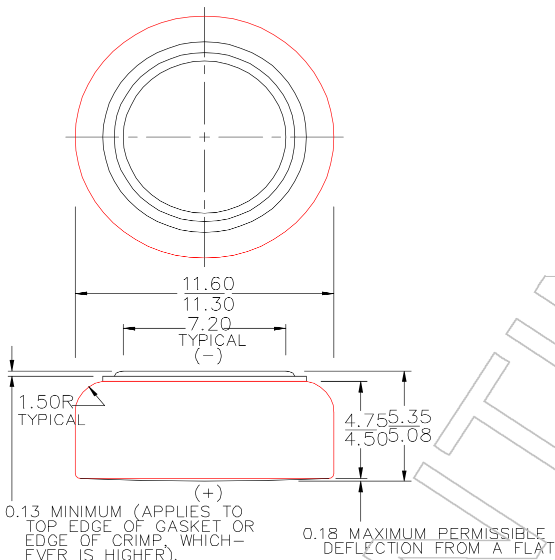
Form No. EBC - 4304A

Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 313



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1152M, IEC-MR44
Average Service Capacity (to 1.2 volts): 245 mAh
(Rated Capacity at 6,500 ohms @ 21°C)
Typical Weight: 2.6 grams (0.09 oz.)
Terminals: Flat Contact
Volume: 0.5 cubic centimeters (0.03 cubic in.)

Dimensions (mm)

Millimeters	Inches
0.13	0.005
0.18	0.007
1.50	0.059
4.50	0.177
4.75	0.187
5.08	0.200
5.35	0.211
7.20	0.283
11.30	0.445
11.60	0.457

IMPORTANT NOTICE

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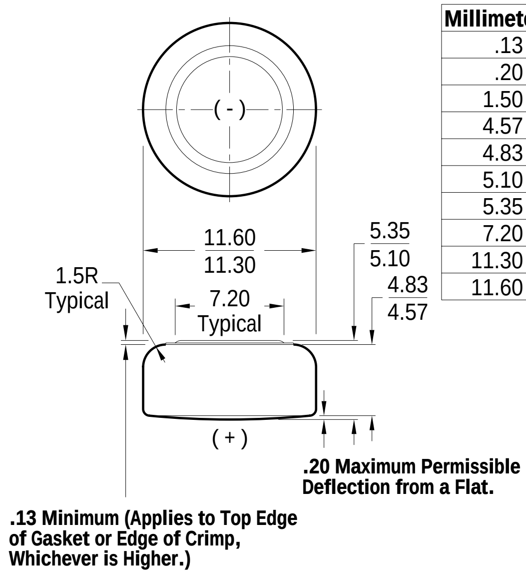
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 357

Dimensions (mm)



Millimeters	Inches
.13	.005
.20	.008
1.50	.059
4.57	.180
4.83	.190
5.10	.201
5.35	.211
7.20	.283
11.30	.445
11.60	.457

Chemical System: Silver Oxide (Zn/Ag_2O)

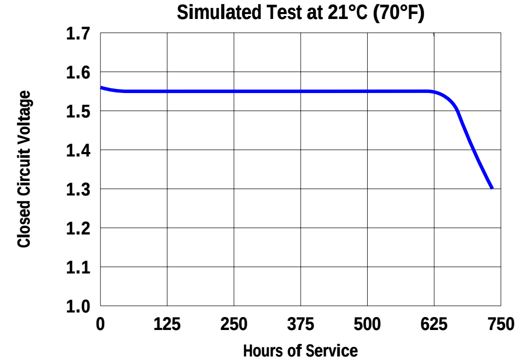
Designation: ANSI / NEDA-1131SO, IEC-SR44
Battery Voltage: 1.55 Volts
Average Weight: 2.3 grams (.08 oz.)
Volume: .57 cubic centimeters (.035 cubic inch)
Average Service Capacity (to 1.3 Volt): 175 mAh
(Rated capacity at 6.5K ohms continuous at 21°C)

DESIGNED FOR USE ON CONTINUOUS LOW DRAIN -HIGH PULSE DRAIN ON DEMAND

SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 1.3V hours
24 hours / day	**.238**	**6,500**	**734**

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°F)



INTERNAL RESISTANCE Closed circuit voltage no less than 1.3 volts on a load of 100 ohms at 21°C (70°F) for 0.1 to 2.0 seconds.

Typical closed circuit voltage during discharge on a load of 100 ohms for 5.0 seconds

Depth of Discharge as Percent of Rated Capacity

Temperature	0%	40%	80%
21°C (70°F)	1.55V	1.40V	1.34V
-10°C (14°F)	1.35V	1.06V	0.90V

IMPORTANT NOTICE

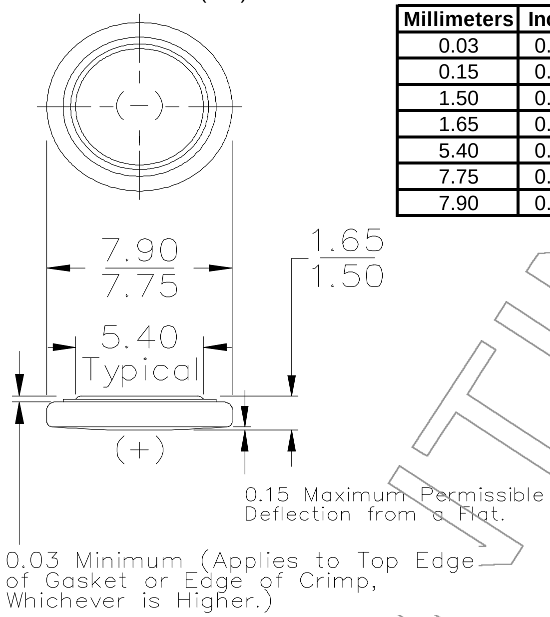
Eveready Battery Company, Inc.

533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 314

Dimensions (mm)

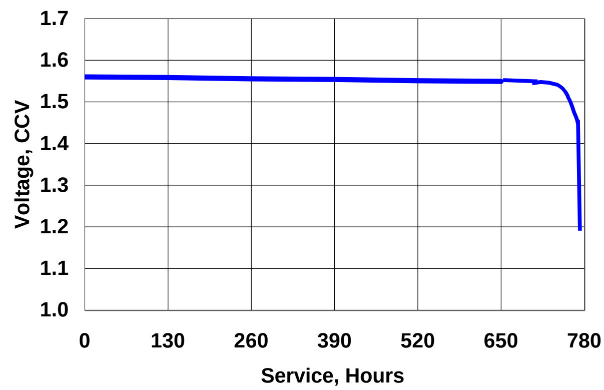


Millimeters	Inches
0.03	0.001
0.15	0.006
1.50	0.059
1.65	0.065
5.40	0.213
7.75	0.305
7.90	0.311

Chemical System: Silver Oxide (Zn/Ag_2O)

Designation: IEC - SR716W
Battery Voltage: 1.55 Volts
Average Weight: 0.35 grams (0.012 oz.)
Volume: 0.081 cubic centimeters (0.005 cubic inch)
Average Service capacity (to 1.3 Volt): 17 mAh
(Rated Capacity at 70k ohms continuous at 21°C)

Typical Discharge Characteristics
Simulated Test at 21ºC (70ºF)



DESIGNED FOR USE ON CONTINUOUS LOW DRAIN
HIGH PULSE DRAIN ON DEMAND

Simulated Application Tests
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	Cutoff Voltage 1.3V
			hours
24 hours / day	0.22	70,000	769

Important Notice

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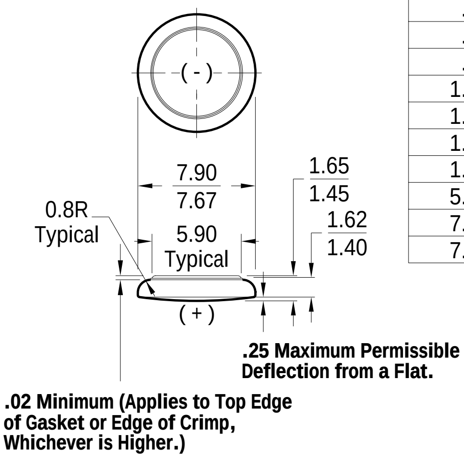
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 315

Dimensions (mm)



Millimeters	Inches
.02	.001
.25	.010
.80	.031
1.40	.055
1.45	.057
1.62	.064
1.65	.065
5.90	.232
7.67	.302
7.90	.311

Chemical System: Silver Oxide ($Zn/Ag_2 0$)

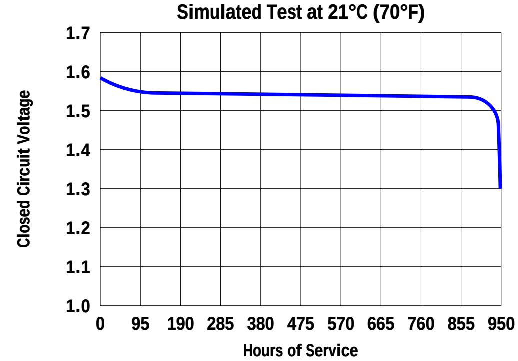
Designation: ANSI / NEDA-1187SO, IEC-SR67
Battery Voltage: 1.55 Volts
Average Weight: .33 grams (.012 oz.)
Volume: .08 cubic centimeters (.005 cubic inch)
Average Service Capacity (to 1.3 Volt): 21 mAh
(Rated capacity at 70K ohms continuous at 21°C)

DESIGNED FOR USE ON CONTINUOUS LOW DRAIN

SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 1.3V hours
24 hours / day	.022	70,000	948

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°F)



INTERNAL RESISTANCE Closed circuit voltage no less than 0.90 volts on a load of 100 ohms at 21°C (70°F) for 0.1 to 2.0 seconds.

Typical closed circuit voltage during discharge on a load of 2,000 ohms for 0.0078 seconds

Depth of Discharge as Percent of Rated Capacity

Temperature	0%	40%	80%
21°C (70°F)	1.58V	1.56V	1.56V
-10°C (14°F)	1.43V	1.39V	1.43V

IMPORTANT NOTICE

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St. Louis, MO 63164
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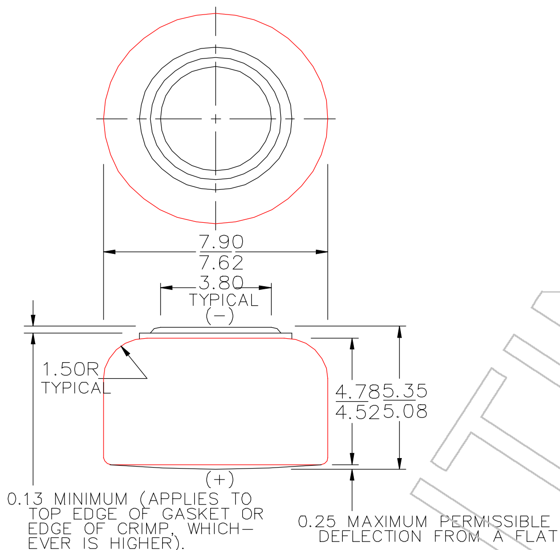
Engineering Data

ENERGIZER NO. 323



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1156M, IEC-MR48
Average Service Capacity (to 1.2 volts): 100 mAh
(Rated Capacity at 13,000 ohms @ 21^{o}C)
Typical Weight: 1.4 grams (0.05 oz.)
Terminals: Flat Contact
Volume: 0.3 cubic centimeters (0.02 cubic in.)

Dimensions (mm)

Millimeters	Inches
0.13	0.005
0.25	0.010
1.50	0.059
3.80	0.150
4.52	0.178
4.78	0.188
5.08	0.200
5.35	0.211
7.62	0.300
7.90	0.311

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St. Louis, MO 63164
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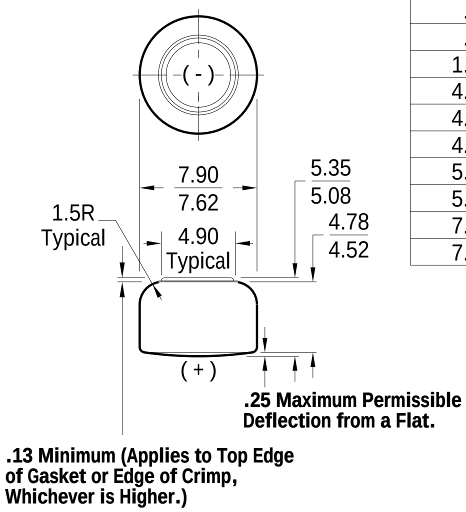
Engineering Data

ENERGIZER NO. 309

Dimensions (mm)



Millimeters	Inches
.13	.005
.25	.010
1.50	.059
4.52	.178
4.78	.188
4.90	.193
5.08	.200
5.35	.211
7.62	.300
7.90	.311

Chemical System: Silver Oxide (Zn/Ag_2O)

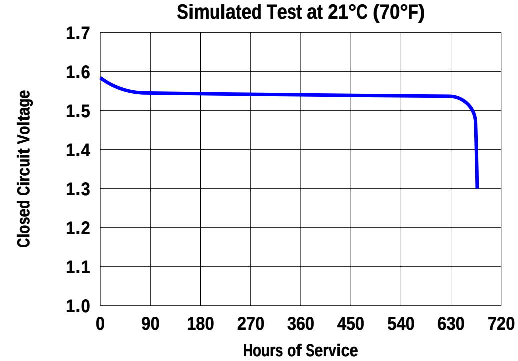
Designation: ANSI / NEDA-1136SO, IEC-SR48
Battery Voltage: 1.55 Volts
Average Weight: 1.13 grams (.04 oz.)
Volume: .26 cubic centimeters (.016 cubic inch)
Average Service Capacity (to 1.3 Volt): 70 mAh
(Rated capacity at 15K ohms continuous at 21°C)

DESIGNED FOR USE ON CONTINUOUS LOW DRAIN

SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 1.3V hours
24 hours / day	.103	15,000	677

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°F)



INTERNAL RESISTANCE Closed circuit voltage no less than 1.00 volts on a load of 100 ohms at 21°C (70°F) for 0.1 to 2.0 seconds.

Typical closed circuit voltage during discharge on a load of 2,000 ohms for 0.0078 seconds

Depth of Discharge as Percent of Rated Capacity

Temperature	0%	40%	80%
21°C (70°F)	1.57V	1.55V	1.54V
-10°C (14°F)	1.44V	1.40V	1.42V

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St. Louis, MO 63164
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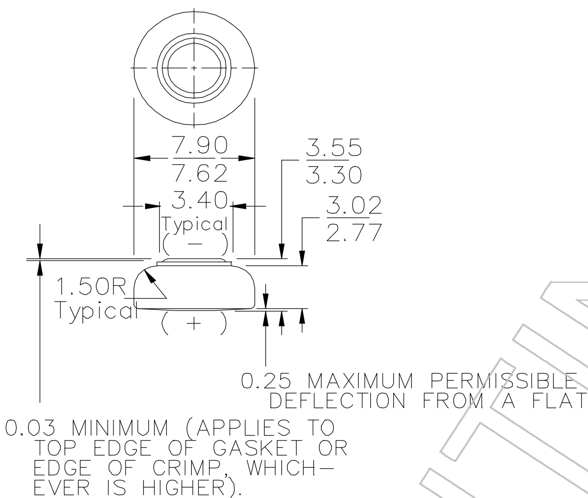
Engineering Data

ENERGIZER NO. 325

Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1155M, IEC-MR41
Average Service Capacity (to 0.9 volts): 55 mAh
(Rated Capacity at 13K ohms @ 20^{o}C)
Typical Weight: 0.9 grams (0.01 oz.)
Volume: 0.2 cubic centimeters (0.01 cubic in.)



Dimensions (mm)

Millimeters	Inches
0.03	0.001
0.25	0.010
1.50	0.059
2.77	0.109
3.02	0.119
3.30	0.130
3.40	0.134
3.55	0.140
7.62	0.300
7.90	0.311

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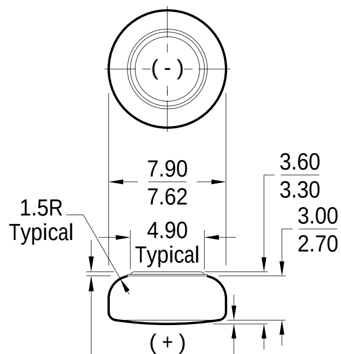
Engineering Data

ENERGIZER NO. 384

Dimensions (mm)



.25 Maximum Permissible Deflection from a Flat.

.03 Minimum (Applies to Top Edge of Gasket or Edge of Crimp, Whichever is Higher.)

Millimeters	Inches
.03	.001
.25	.010
1.50	.059
2.70	.106
3.00	.118
3.30	.130
3.60	.142
4.90	.193
7.62	.300
7.90	.311

Chemical System: Silver Oxide (Zn/$Ag_2$0)

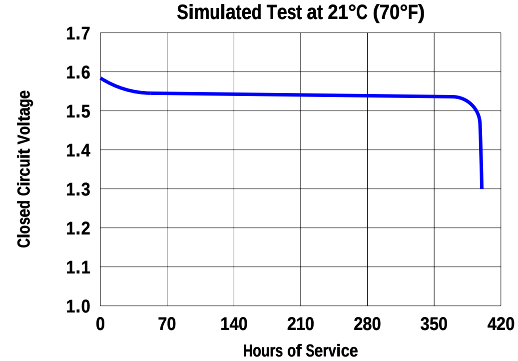
Designation: ANSI / NEDA-1134SO, IEC-SR41
Battery Voltage: 1.55 Volts
Average Weight: .57 grams (.020 oz.)
Volume: .18 cubic centimeters (.011 cubic inch)
Average Service Capacity (to 1.3 Volt): 41 mAh
(Rated capacity at 15K ohms continuous at 21°C)

DESIGNED FOR USE ON CONTINUOUS LOW DRAIN

SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 1.3V hours
24 hours / day	.103	15,000	400

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°F)



INTERNAL RESISTANCE Closed circuit voltage no less than 1.00 volts on a load of 100 ohms at 21°C (70°F) for 0.1 to 2.0 seconds.

Typical closed circuit voltage during discharge on a load of 2,000 ohms for 0.0078 seconds

Depth of Discharge as Percent of Rated Capacity

Temperature	0%	40%	80%
21°C (70°F)	1.57V	1.55V	1.54V
-10°C (14°F)	1.44V	1.44V	1.43V

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Checkerboard Square
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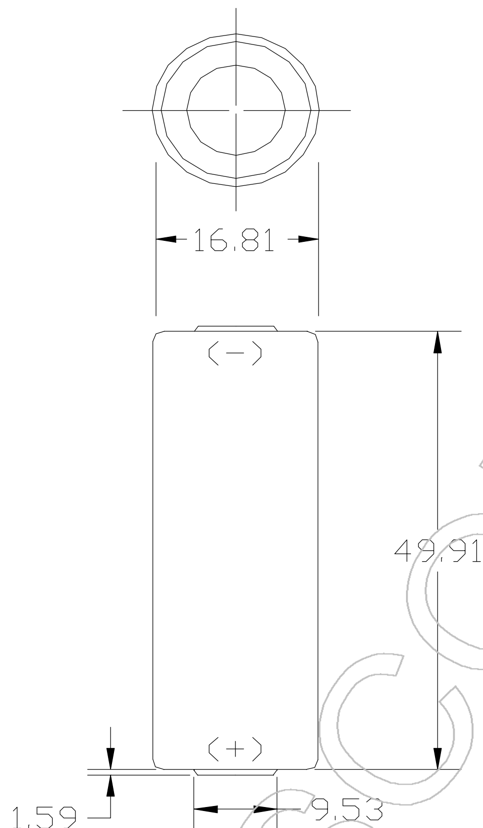
Engineering Data

Zinc Chloride ***4.5V***

EVEREADY NO. 333-CZ

Dimensions (mm)



Chemical System:Zinc-Manganese Dioxide (Zn/MnO_2)

Battery Voltage: 4.5 Volts
Average Weight: 25.5 grams (0.9 oz.)
Volume: 16.5 cubic centimeters (0.65 cubic inch)
Cell: Six No. 108 (ANSI F12)
(two parallel strings of three in series)
Terminals: Flat contacts
Jacket: Metal

Millimeters	Inches
1.590	0.063
9.530	0.375
16.810	0.662
49.910	1.965

Important Notice

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Eveready Battery Company, Inc.

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St. Louis, MO 63164
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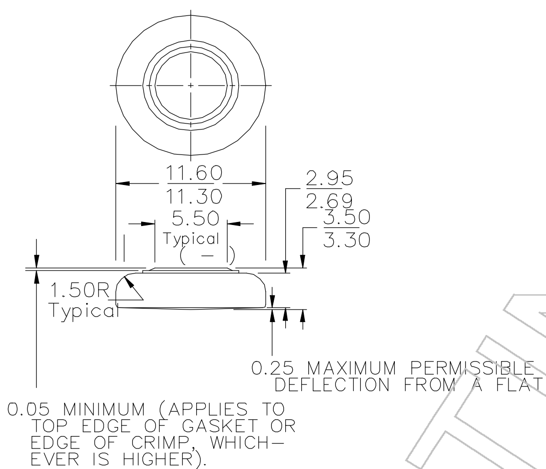
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 343

Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1154M, IEC-MR42
Average Service Capacity (to 1.2 volts): 120 mAh
(Rated Capacity at 13K ohms @ 20^{o}C)
Typical Weight: 1.7 grams (0.06 oz.)
Volume: 0.3 cubic centimeters (0.02 cubic in.)



DESIGNED FOR USE ON CONTINUOUS LOW DRAIN

Dimensions (mm)

Millimeters	Inches
0.05	0.002
0.25	0.010
1.50	0.059
2.69	0.106
2.95	0.116
3.30	0.130
3.50	0.138
5.50	0.217
11.30	0.445
11.60	0.457

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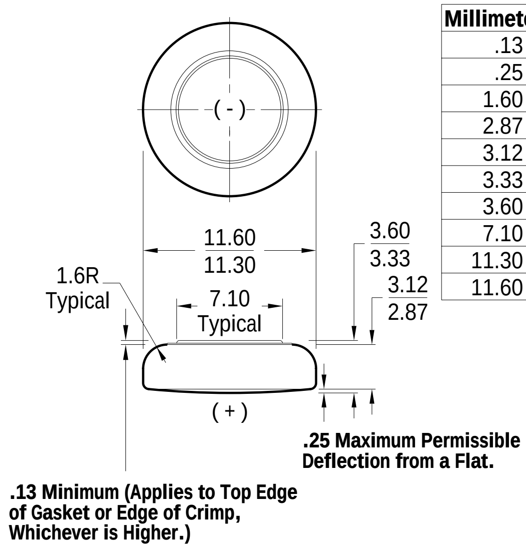
Engineering Data

ENERGIZER NO. 344

Dimensions (mm)



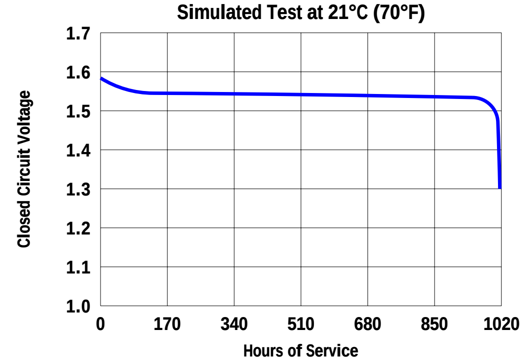
Millimeters	Inches
.13	.005
.25	.010
1.60	.063
2.87	.113
3.12	.123
3.33	.131
3.60	.142
7.10	.280
11.30	.445
11.60	.457

Chemical System: Silver Oxide ($Zn/Ag_2 0$)

Designation: ANSI / NEDA-1139SO, IEC-SR42
Battery Voltage: 1.55 Volts
Average Weight: 1.6 grams (.06 oz.)
Volume: .37 cubic centimeters (.023 cubic inch)
Average Service Capacity (to 1.3 Volt): 105 mAh
(Rated capacity at 15K ohms continuous at 21°C)

DESIGNED FOR USE ON CONTINUOUS LOW DRAIN

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°F)



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 1.3V
			hours
24 hours / day	.103	15,000	1,016

INTERNAL RESISTANCE Closed circuit voltage no less than 0.90 volts on a load of 100 ohms at 21°C (70°F) for 0.1 to 2.0 seconds.

Typical closed circuit voltage during discharge on a load of 2,000 ohms for 0.0078 seconds

Depth of Discharge as Percent of Rated Capacity

Temperature	0%	40%	80%
21°C (70°F)	1.58V	1.56V	1.56V
-10°C (14°F)	1.46V	1.44V	1.48V

IMPORTANT NOTICE

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Form No. EPS - 4316A

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St. Louis, MO 63164
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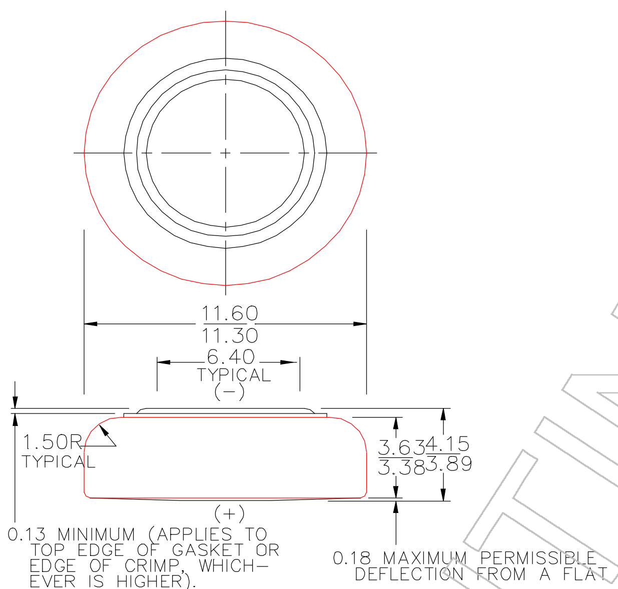
Engineering Data

ENERGIZER NO. 354



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1153M, IEC-MR43
Average Service Capacity (to 1.2 volts): 160 mAh
(Rated Capacity at 6,500 ohms @ 21^{o}C)
Typical Weight: 2.0 grams (0.07 oz.)
Volume: 0.3 cubic centimeters (0.02 cubic in.)
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.13	0.005
0.18	0.007
1.50	0.059
3.38	0.133
3.63	0.143
3.89	0.153
4.15	0.163
6.40	0.252
11.30	0.445
11.60	0.457

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St. Louis, MO 63164
Telephone: 1-800-383-7323
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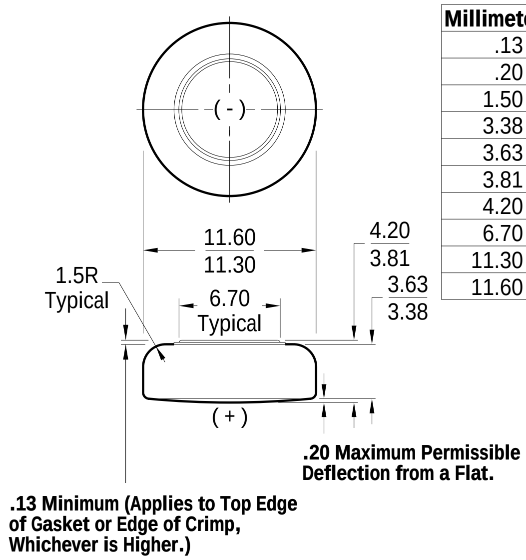
Engineering Data

ENERGIZER NO. 301

Dimensions (mm)



Millimeters	Inches
.13	.005
.20	.008
1.50	.059
3.38	.133
3.63	.143
3.81	.150
4.20	.165
6.70	.265
11.30	.445
11.60	.457

Chemical System: Silver Oxide ($Zn/Ag_2 0$)

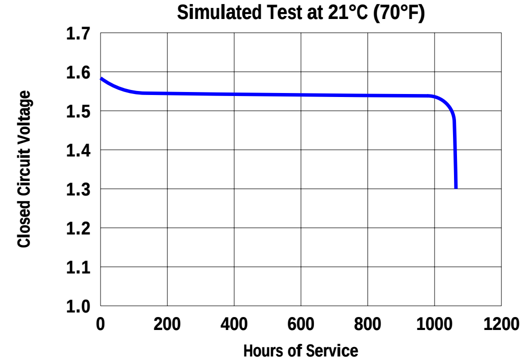
Designation: ANSI / NEDA-1132SO, IEC-SR43
Battery Voltage: 1.55 Volts
Average Weight: 1.7 grams (.06 oz.)
Volume: .44 cubic centimeters (.027 cubic inch)
Average Service Capacity (to 1.3 Volt): 110 mAh
(Rated capacity at 15K ohms continuous at 21°C)

DESIGNED FOR USE ON CONTINUOUS LOW DRAIN

SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 1.3V hours
24 hours / day	.103	15,000	1,064

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°F)



INTERNAL RESISTANCE Closed circuit voltage no less than 0.95 volts on a load of 100 ohms at 21°C (70°F) for 0.1 to 2.0 seconds.

Typical closed circuit voltage during discharge on a load of 2,000 ohms for 0.0078 seconds

Depth of Discharge as Percent of Rated Capacity

Temperature	0%	40%	80%
21°C (70°F)	1.58V	1.56V	1.56V
-10°C (14°F)	1.46V	1.43V	1.50V

IMPORTANT NOTICE

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Checkerboard Square
St. Louis, MO 63164
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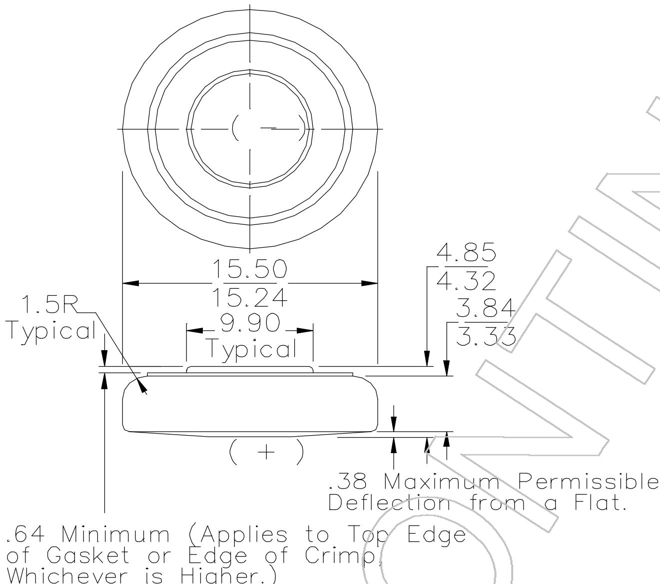
Engineering Data

ENERGIZER NO. 355



Chemical System: Silver Oxide (Zn/Ag 0)
Designation: ANSI / NEDA-1140S0
Voltage: 1.5V
Average Service Capacity (to 1.3 volts): 240 mAh
(Rated Capacity at 6.5K ohms continuous @ 21°C)
Typical Weight: 3.69 grams (.13 oz.)
Volume: .92 cubic centimeters (0.06 cubic in.)

Dimensions (mm)

Millimeters	Inches
0.38	0.015
0.64	0.025
1.50	0.059
3.33	0.131
3.84	0.151
4.32	0.170
4.85	0.191
9.90	0.390
15.24	0.600
15.50	0.610

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St. Louis, MO 63164
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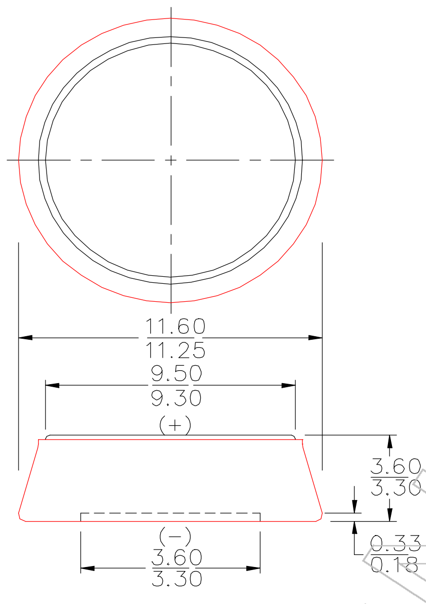
Engineering Data

ENERGIZER NO. 387



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1151M, IEC-MR42
Average Service Capacity (to 1.2 volts): 80 mAh
(Rated Capacity at 13,000 ohms @ 21°C)
Typical Weight: 1.4 grams (0.05 oz.)
Volume: 0.3 cubic centimeters (0.02 cubic in.)
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.18	0.007
0.33	0.013
3.30	0.130
3.60	0.142
6.48	0.255
6.73	0.265
9.30	0.366
9.50	0.374
11.25	0.443
11.60	0.457

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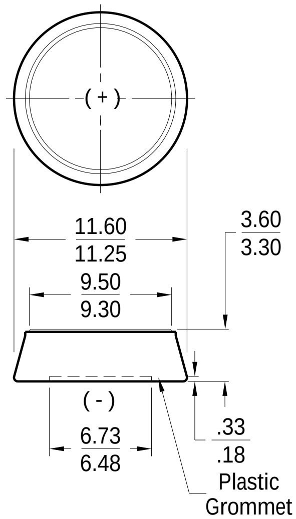
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 387S

Dimensions (mm)



Millimeters	Inches
.18	.007
.33	.013
3.30	.130
3.60	.142
6.48	.255
6.73	.265
9.30	.366
9.50	.374
11.25	.443
11.60	.457

Chemical System: Silver Oxide (Zn/$Ag_2$0)

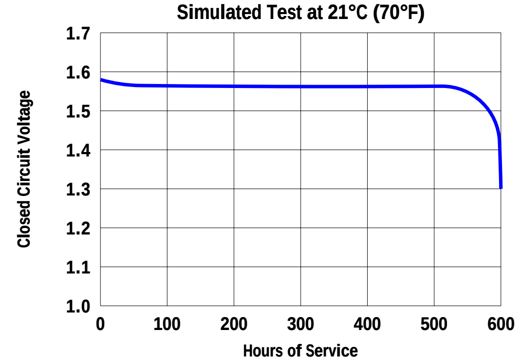
Designation: IEC-SR42
Battery Voltage: 1.55 Volts
Average Weight: 1.0 grams (.035 oz.)
Volume: .30 cubic centimeters (.02 cubic inch)
Average Service Capacity (to 1.3 Volt): 60 mAh
(Rated capacity at 15K ohms continuous at 21°C)

DESIGNED FOR USE ON CONTINUOUS LOW DRAIN

SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 1.3V
			hours
24 hours / day	.103	15,000	600

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°F)



INTERNAL RESISTANCE Closed circuit voltage no less than 0.90 volts on a load of 100 ohms at 21°C (70°F) for 0.1 to 2.0 seconds.

Typical closed circuit voltage during discharge on a load of 2,000 ohms for 0.0078 seconds

Depth of Discharge as Percent of Rated Capacity

Temperature	0%	40%	80%
21°C (70°F)	1.57V	1.55V	1.55V
-10°C (14°F)	1.36V	1.38V	1.44V

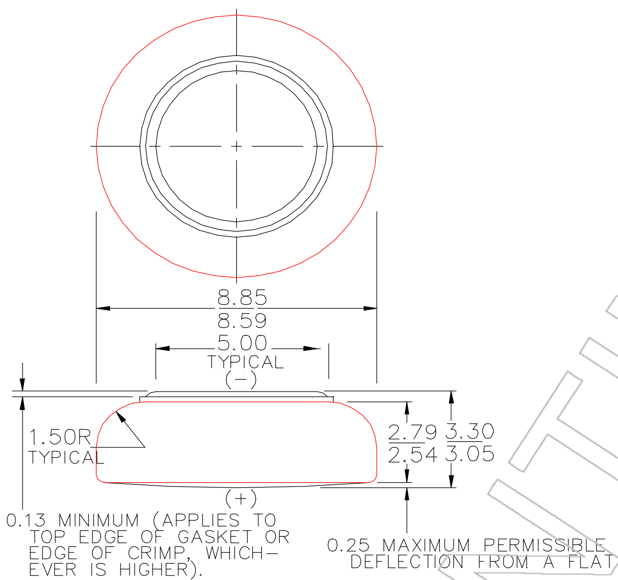
IMPORTANT NOTICE

Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 388



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1157M
Average Service Capacity (to 1.2 volts): 60 mAh
(Rated Capacity at 20,000 ohms @ 21°C)
Typical Weight: 1.1 grams (0.04 oz.)
Volume: 0.2 cubic centimeters (0.01 cubic in.)
Terminals: Flat contact

Dimensions (mm)

Millimeters	Inches
0.13	0.005
0.25	0.010
1.50	0.059
2.54	0.100
2.79	0.110
3.05	0.120
3.30	0.130
5.00	0.197
8.59	0.338
8.85	0.348

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Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
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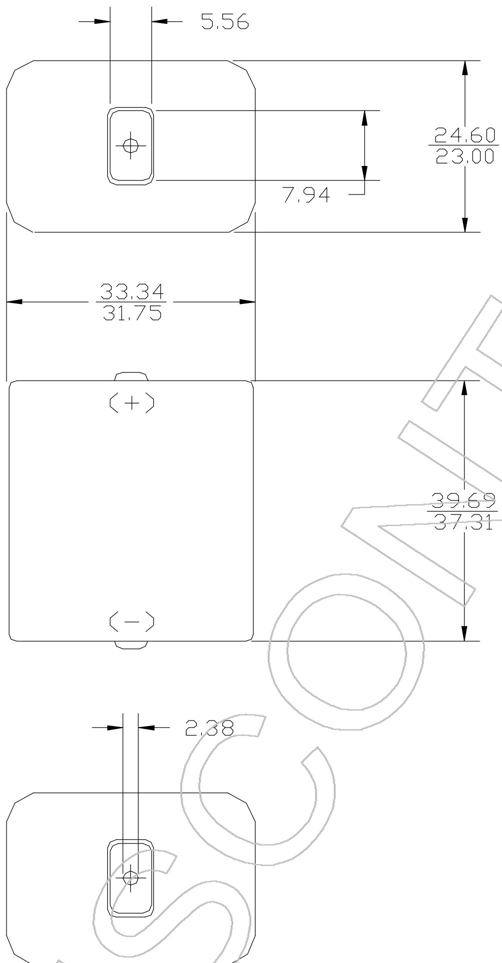
Engineering Data

LeClanche ***15V***

EVEREADY NO. 417

Dimensions (mm)



Chemical System:LeClanche-Manganese Dioxide (Zn/MnO2)
Battery Voltage: 15 Volts
Average Weight: 51.0 grams (1.8 oz.)
Volume: 30.6 cubic centimeters (1.87 cubic inch)
Cell: Ten No. 132 (ANSI F30) in series

Terminals: Flat contacts with holes

Millimeters	Inches
2.38	0.094
5.56	0.219
7.94	0.313
23.00	0.906
24.60	0.969
31.75	1.251
33.34	1.314
37.31	1.470
39.69	1.564

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Eveready Battery Company, Inc.
Checkerboard Square
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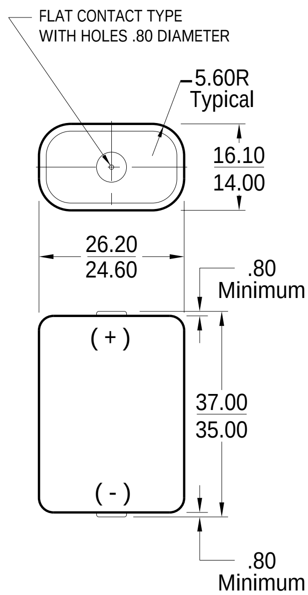
Internet: www.energizer.com

Engineering Data

EVEREADY NO. 411

*Zinc Chloride **15V***
No Added Mercury or Cadmium

Dimensions (mm)

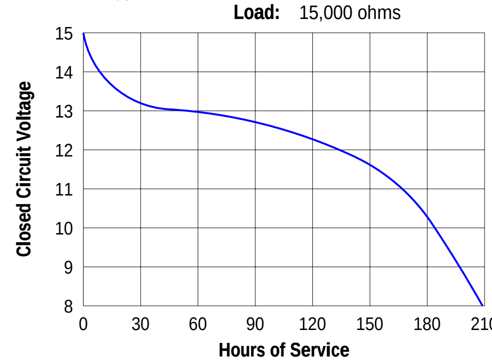


Millimeters	Inches
.80	.031
5.60	.220
14.00	.551
16.10	.634
24.60	.969
26.20	1.031
35.00	1.378
37.00	1.457

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-208, IEC-10F20
Battery Voltage: 15 Volts
Average Weight: 27 grams (1.0 oz.)
Volume: 15 cubic centimeters (0.9 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 140 mAh
(Rated capacity at 25 mA continuous drain)
Cells: Ten No. 112 in series
Jacket: Metal

TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 4 hours/day
Typical Drain @ 12V: 0.8 milliamperes
Load: 15,000 ohms



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 12V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 8.0V	9.0V	10V	11V	12V	13V
			hours					
4 hours / day	0.8	15,000	209	197	184	167	134	55

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Energizer

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

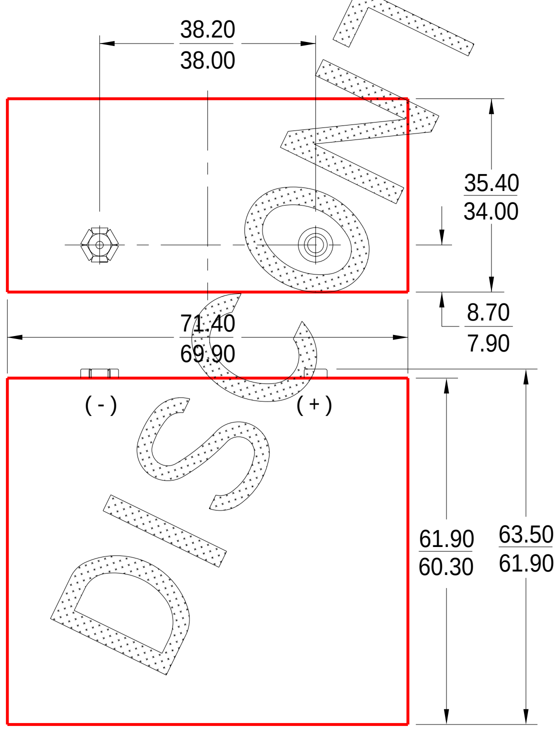
EVEREADY NO. 457

LeClanche ***67.5V***
No Added Mercury or Cadmium

Chemical System: LeClanche-Manganese Dioxide ($Zn/Mn0_2$)

Designation: ANSI / NEDA-203, IEC-45F30
Battery Voltage: 67.5 Volts
Average Weight: 227 grams (8.0 oz.)
Volume: 154 cubic centimeters (9.4 cubic inch)
Cells: Eighty eight No. 112-Two parallel strings of four in series.

Dimensions (mm)



Millimeters	Inches
7.90	.311
8.70	.343
34.00	1.339
35.40	1.394
38.00	1.496
38.20	1.504
60.30	2.374
61.90	2.437
63.50	2.500
69.90	2.752
71.40	2.811

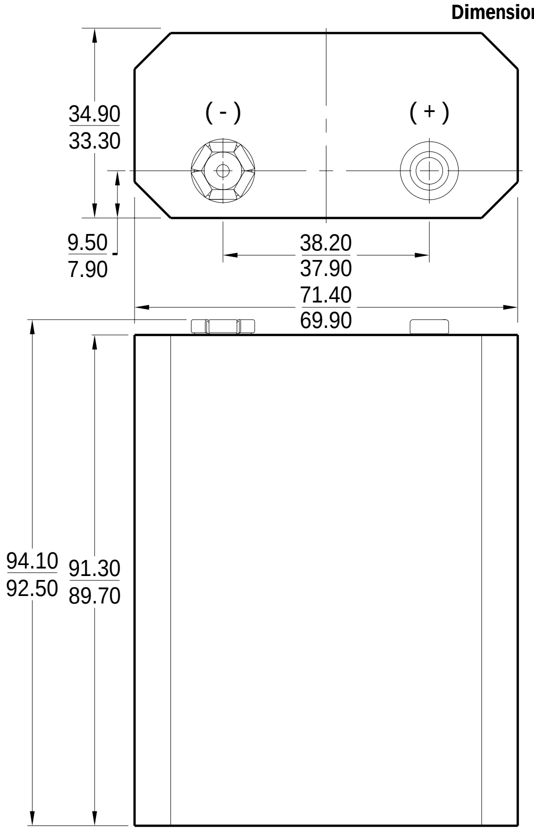
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

EVEREADY NO. 467

Zinc Chloride ***67.5V***
No Added Mercury or Cadmium

Dimensions (mm)

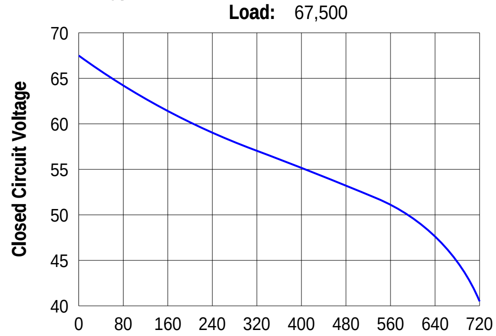


Millimeters	Inches
7.90	.311
9.50	.374
33.30	1.311
34.90	1.374
37.90	1.492
38.20	1.504
69.90	2.752
71.40	2.811
89.70	3.531
91.30	3.594
92.50	3.642
94.10	3.705

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-200, IEC-45F40
Battery Voltage: 67.5 Volts
Average Weight: 343 grams (12.1 oz.)
Volume: 228 cubic centimeters (13.9 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 550 mAh
(Rated capacity at 25 mA continuous drain)
Cells: Forty Five No. 130 in series
Jacket: Metal

TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 4 hours/day
Typical Drain @ 54V: 0.8 milliamperes
Load: 67,500



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 54V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 36V	40.5V	45V	49.5	54V	58.5V
			hours					
4 hours / day	0.8	67,500	-	720	678	603	448	260
4 hours / day	7.2	7,500	-	71	66	42	28	11

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Eveready Battery Company, Inc.

Checkerboard Square
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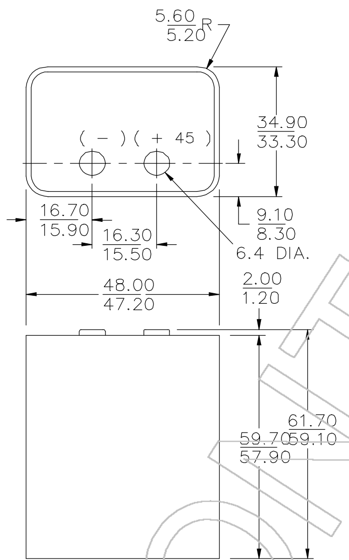
Engineering Data

ENERGIZER NO. 460



Chemical System: LeClanche
Designation: N/A
Typical Weight: N/A
Volume: N/A

Dimensions (mm)

Millimeters	Inches
1.20	0.047
2.00	0.079
5.20	0.205
5.60	0.220
6.40	0.252
8.30	0.327
9.10	0.358
15.50	0.610
15.90	0.626
16.30	0.642
16.70	0.657
33.30	1.311
34.90	1.374
47.20	1.858
48.00	1.890
57.90	2.280
59.10	2.327
59.70	2.350
61.70	2.429

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Eveready Battery Company, Inc.
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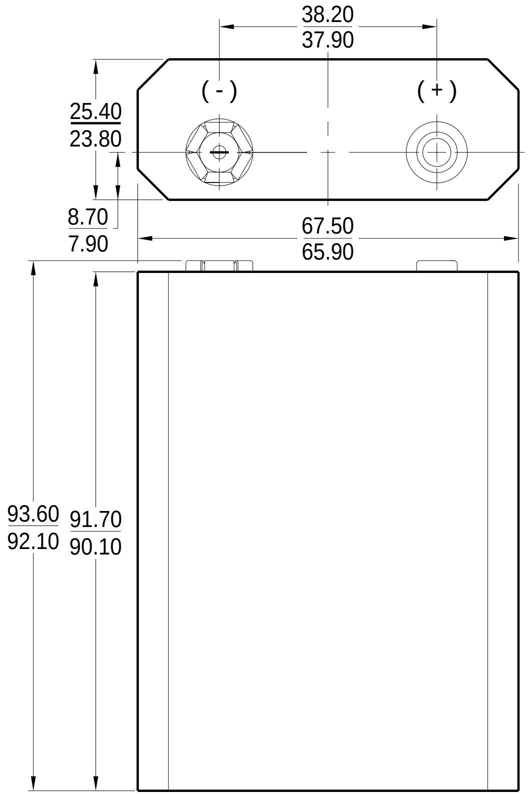
Engineering Data

EVEREADY NO. 455

Zinc Chloride ***45V***
No Added Mercury or Cadmium

Dimensions (mm)

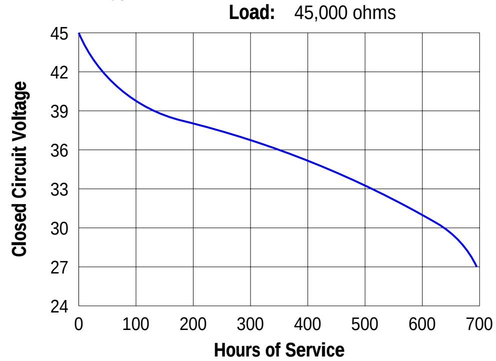


Millimeters	Inches
7.90	.311
8.70	.343
23.80	.937
25.40	1.000
37.90	1.492
38.20	1.504
65.90	2.594
67.50	2.657
90.10	3.547
91.70	3.610
92.10	3.626
93.60	3.685

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-201, IEC-30F40
Battery Voltage: 45 Volts
Average Weight: 231 grams (8.2 oz.)
Volume: 157 cubic centimeters (9.6 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 550 mAh
(Rated capacity at 25 mA continuous drain)
Cells: Thirty No. 130 in series
Jacket: Paper

TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 4 hours/day
Typical Drain @ 36V: 0.8 milliamperes
Load: 45,000 ohms



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 36V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 24V	27V	30V	33V	36V	39V
			hours					
4 hours / day	0.8	45,000	-	695	638	512	350	130
4 hours / day	7.2	5,000	70	62	52	39	28	12

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

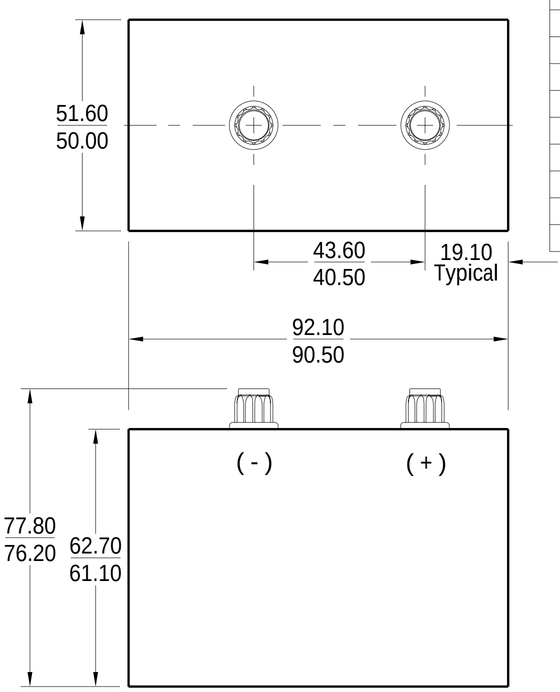
Engineering Data

EVEREADY NO. 763

*Zinc Chloride **22.5V***
No Added Mercury or Cadmium

Dimensions (mm)

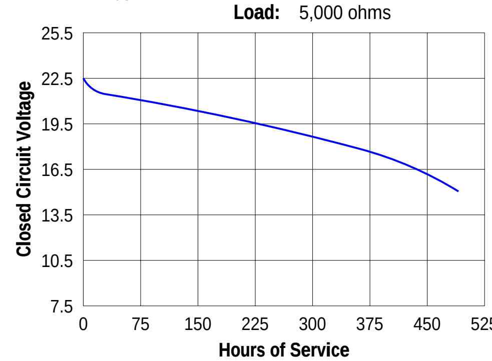
Millimeters	Inches
19.10	.752
40.50	1.594
43.60	1.717
50.00	1.969
51.60	2.031
61.10	2.406
62.70	2.469
76.20	3.000
77.80	3.063
90.50	3.563
92.10	3.626



Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-710
Battery Voltage: 22.5 Volts
Average Weight: 372 grams (13.2 oz.)
Volume: 311 cubic centimeters (19 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 1.7 Ah
(Rated capacity at 25 mA continuous drain)
Cells: Forty Five No. 130-Three parallel strings of fifteen in series
Jacket: Paper

TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 24 hours/day
Typical Drain @ 18V: 3.6 milliamperes
Load: 5,000 ohms



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 18V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 12V	13.5V	15V	16.5V	18V	19.5V
			hours					
24 hours / day	3.6	5,000	-	-	491	435	347	227
4 hours / day	14.4	1,250	135	125	112	92	75	46

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Form No. EPS - 3233B

Energizer

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

EVEREADY NO. 490

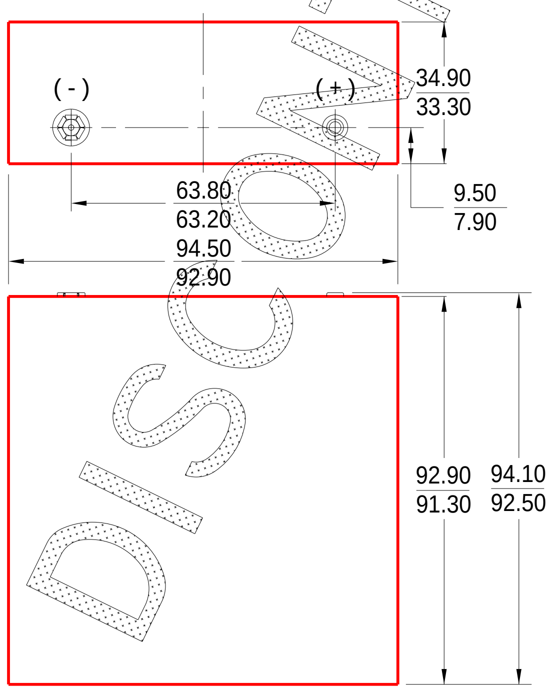
*LeClanche **90V***
No Added Mercury or Cadmium

Chemical System: LeClanche-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-204, IEC-60F40
Battery Voltage: 90 Volts
Average Weight: 460 grams (16.2 oz.)
Volume: 306 cubic centimeters (18.7 cubic inch)
Cells: Sixty No. 135 in series.

Dimensions (mm)

Millimeters	Inches
7.90	.311
9.50	.374
33.30	1.311
34.90	1.374
63.20	2.488
63.80	2.512
91.30	3.594
92.50	3.642
92.90	3.657
94.10	3.705
94.50	3.720



Eveready Battery Company, Inc.
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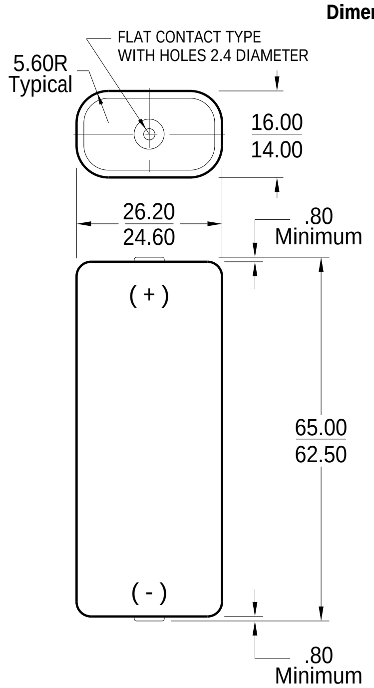
Engineering Data

EVEREADY NO. 413

*Zinc Chloride **30V***
No Added Mercury or Cadmium

Dimensions (mm)

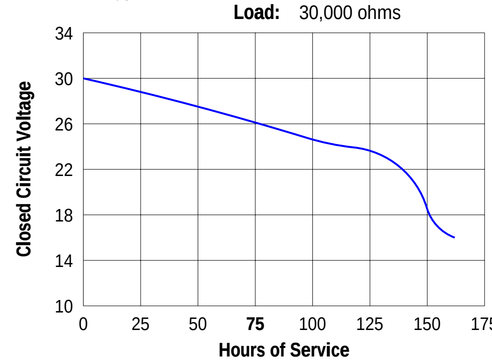


Millimeters	Inches
.80	.031
2.40	.094
5.60	.220
14.00	.551
16.00	.630
24.60	.969
26.20	1.031
62.50	2.461
65.00	2.559

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-210, IEC-20F20
Battery Voltage: 30 Volts
Average Weight: 48 grams (1.7 oz.)
Volume: 27 cubic centimeters (1.6 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 140 mAh
(Rated capacity at 25 mA continuous drain)
Cells: Twenty No. 112 in series
Jacket: Metal

TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 4 hours/day
Typical Drain @ 24V: 0.8 milliamperes
Load: 30,000 ohms



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 24V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 16V (hours)	18V	20V	22V	24V	26V
4 hours / day	0.8	30,000	162	151	147	138	115	77

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
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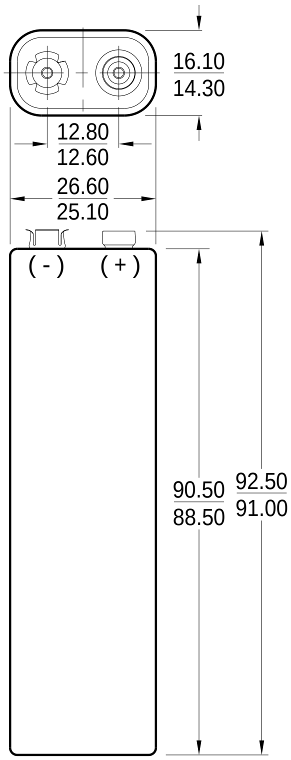
Engineering Data

EVEREADY NO. 415

*Zinc Chloride **45V***
No Added Mercury or Cadmium



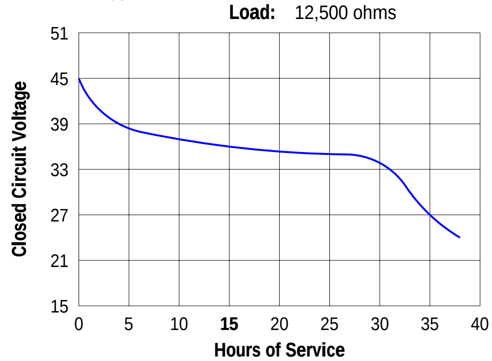
Dimensions (mm)

Millimeters	Inches
12.60	.496
12.80	.504
14.30	.563
16.10	.634
25.10	.988
26.60	1.047
88.50	3.484
90.50	3.563
91.00	3.583
92.50	3.642

Chemical System: Zinc-Manganese Dioxide ($Zn/Mn0_2$)

Designation: ANSI-213, IEC-30F20
Battery Voltage: 45 Volts
Average Weight: 76 grams (2.7 oz.)
Volume: 53 cubic centimeters (3.2 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 140 mAh
(Rated capacity at 25 mA continuous drain)
Cells: Thirty No. 112 in series
Jacket: Metal

TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 4 hours/day
Typical Drain @ 36V: 2.9 milliamperes
Load: 12,500 ohms



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 36V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 24V	27V	30V	33V	36V	39V
			hours					
4 hours / day	2.9	12,500	38	35	33	31	15	4

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
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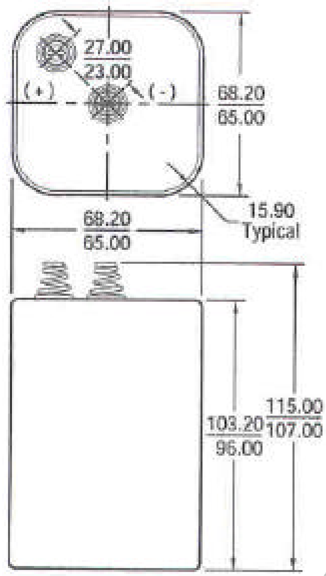
Internet: www.energizer.com

Engineering Data

EVEREADY NO. 509

Zinc Chloride ***6V***
Classic
No Added Mercury or Cadmium



Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

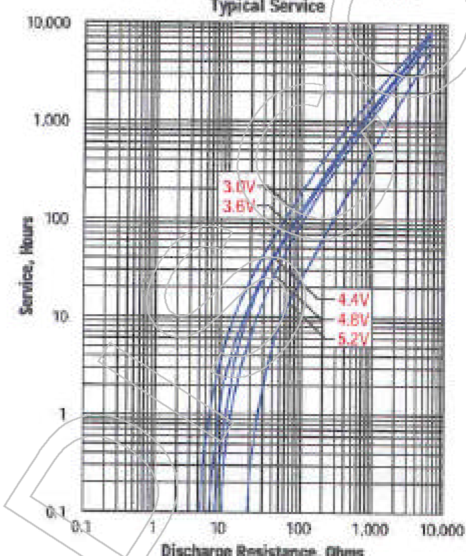
Designation: ANSI-908, IEC-4R25
Battery Voltage: 6 Volts
Average Weight: 600 grams (21.2 oz.)
Volume: 492 cubic centimeters (30 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 10.5 Ah
(Rated capacity at 25 mA continuous drain)
Cells: Four No. 60 (size "F") in series.
Jacket: Plastic

Dimensions (mm)

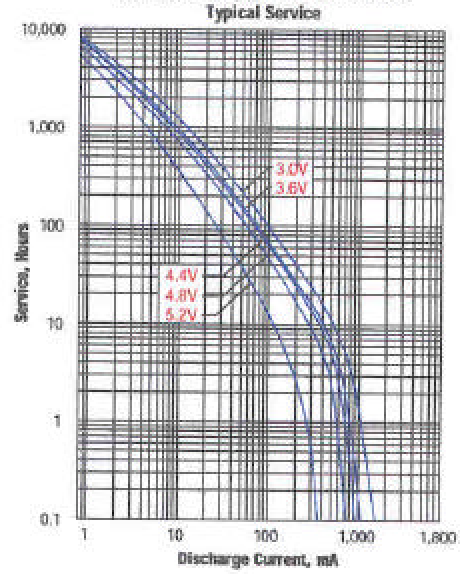
Millimeters	Inches
15.90	.626
23.00	.906
27.00	1.063
65.00	2.559
68.20	2.685
82.60	3.252
96.00	3.780
101.60	4.000
103.20	4.063
107.00	4.213
115.00	4.528

THIS BATTERY SHALL PASS FREELY THROUGH A CYLINDRICAL TUBE 82.6 DIAMETER X 101.6 LONG.

CONSTANT RESISTANCE PERFORMANCE
Typical Service



CONSTANT CURRENT PERFORMANCE
Typical Service



Form No. EPS - 3105B

[redacted]

INTERNAL RESISTANCE VS TEMPERATURE This measurement is an approximation of the battery's actual internal resistance. It is sensitive to the loads selected and operator technique.

Schedule: Background Load 600 ohms, Pulse Load 10 ohms, Pulse Duration 1 second.

Temperature	Typical Ri (ohms)
45°C (113°F)	0.7
21°C (70°F)	0.8
0°C (32°F)	1.6
-20°C (-4°F)	10.0

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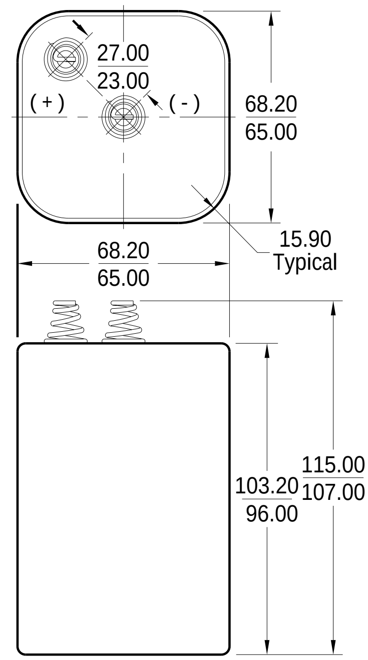
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

EVEREADY NO. 1209

Zinc Chloride ***6V***
Super Heavy Duty
No Added Mercury or Cadmium



Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

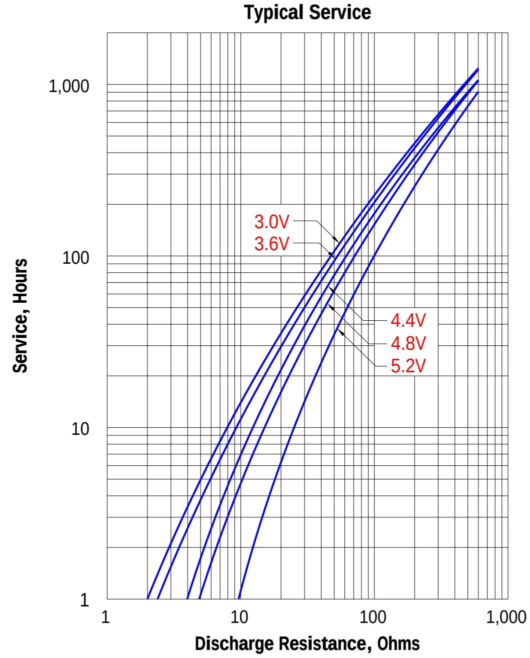
Designation: ANSI-908D, IEC-4R25
Battery Voltage: 6 Volts
Average Weight: 600 grams (21.2 oz.)
Volume: 492 cubic centimeters (30 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 12.0 Ah
(Rated capacity at 25 mA continuous drain)
Cells: Four No. 60 (size "F") in series.
Jacket: Plastic

Dimensions (mm)

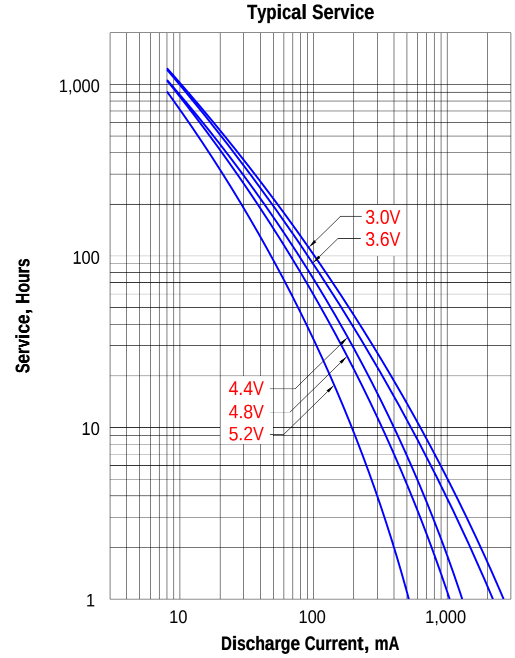
Millimeters	Inches
15.90	.626
23.00	.906
27.00	1.063
65.00	2.559
68.20	2.685
82.60	3.252
96.00	3.780
101.60	4.000
103.20	4.063
107.00	4.213
115.00	4.528

THIS BATTERY SHALL PASS FREELY THROUGH A CYLINDRICAL TUBE 82.6 DIAMETER X 101.6 LONG.

CONSTANT RESISTANCE PERFORMANCE
Typical Service

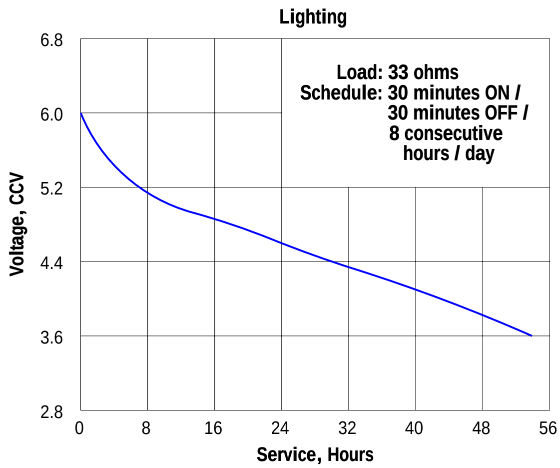


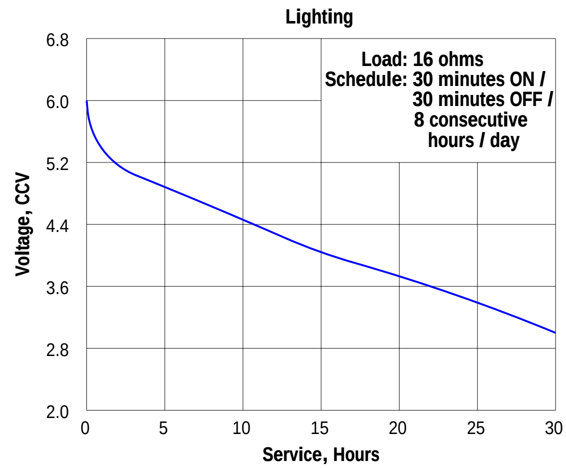
CONSTANT CURRENT PERFORMANCE
Typical Service

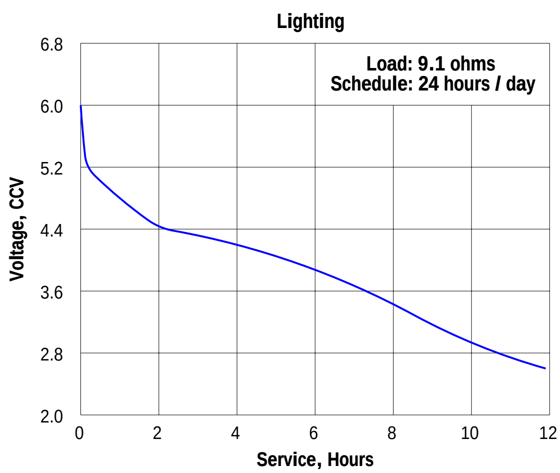


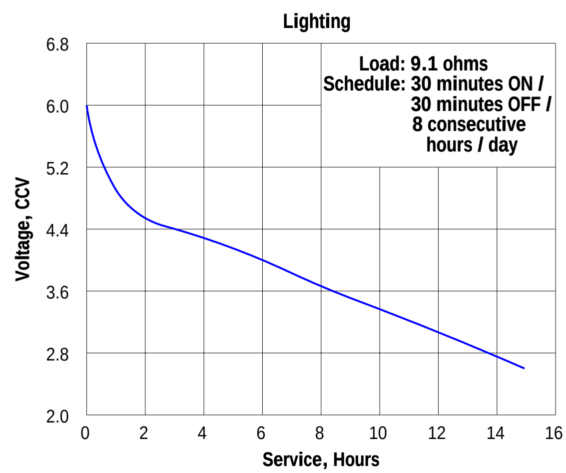
EVEREADY NO. 1209

TYPICAL APPLICATIONS









INTERNAL RESISTANCE VS TEMPERATURE This measurement is an approximation of the battery's actual internal resistance. It is sensitive to the loads selected and operator technique.

Schedule: Background Load 600 ohms, Pulse Load 10 ohms, Pulse Duration 1 second.

Temperature	Typical Ri (ohms)
45°C (113°F)	0.7
21°C (70°F)	0.9
0°C (32°F)	1.0
-20°C (-4°F)	10.0

IMPORTANT NOTICE

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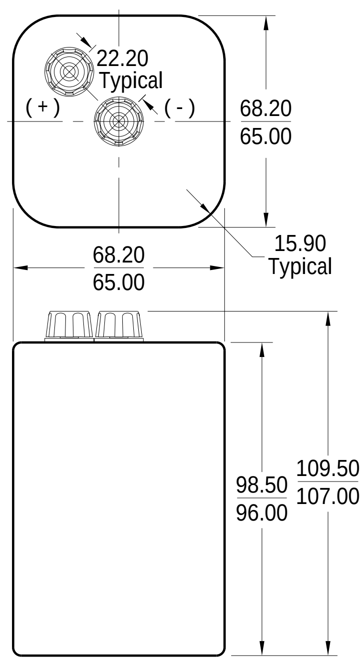
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

EVEREADY NO. 510S

Zinc Chloride ***6V***
Classic
No Added Mercury or Cadmium



Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

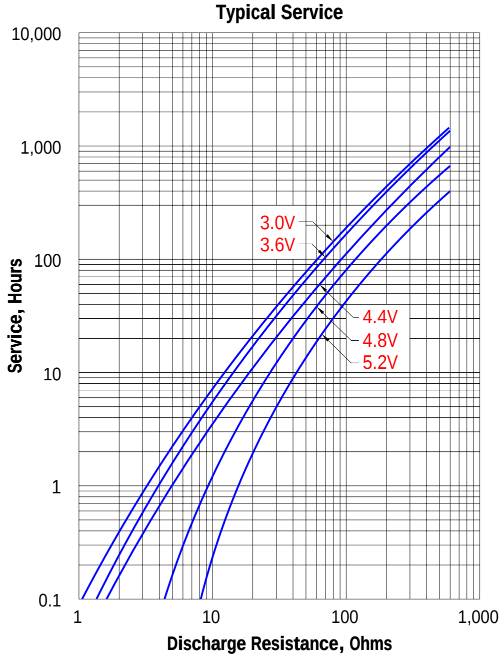
Designation: ANSI-915, IEC-4R25
Battery Voltage: 6 Volts
Average Weight: 600 grams (21.2 oz.)
Volume: 485.7 cubic centimeters (29.6 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 11.0 Ah
(Rated capacity at 25 mA continuous drain)
Cells: Four No. 60 (size "F") in series.
Jacket: Plastic

Dimensions (mm)

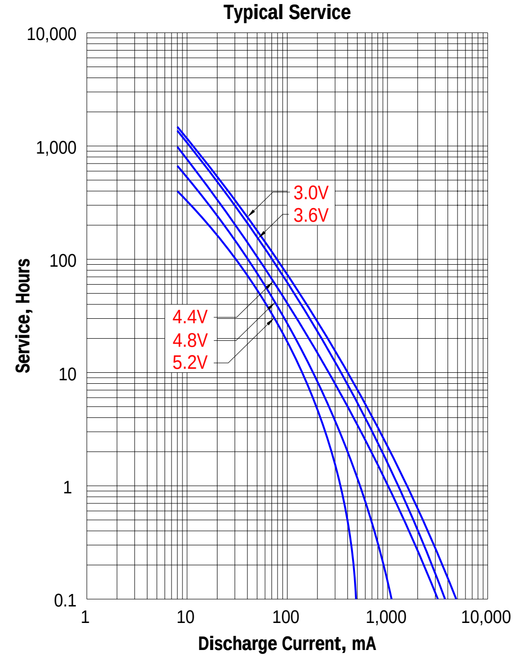
Millimeters	Inches
15.90	.626
21.80	.858
23.40	.921
65.00	2.559
68.20	2.685
82.60	3.252
96.00	3.780
101.60	4.000
103.20	4.063
107.00	4.213
112.00	4.409

THIS BATTERY SHALL PASS FREELY THROUGH A CYLINDRICAL TUBE 82.6 DIAMETER X 101.6 LONG.

CONSTANT RESISTANCE PERFORMANCE
Typical Service

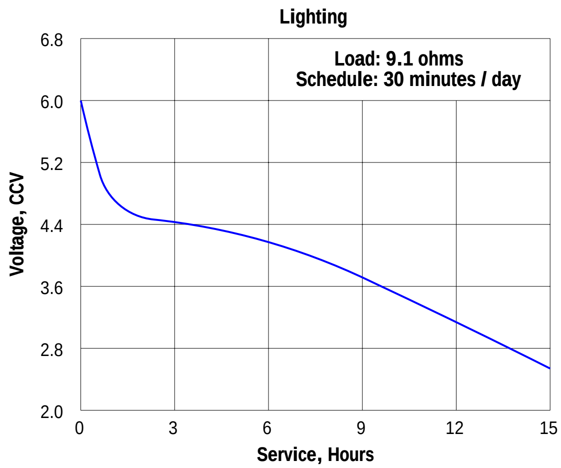


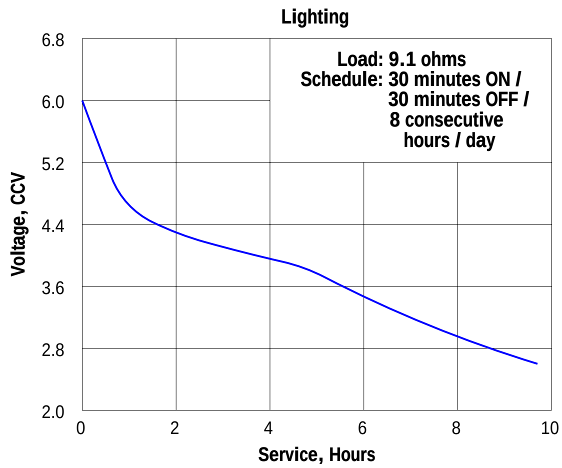
CONSTANT CURRENT PERFORMANCE
Typical Service

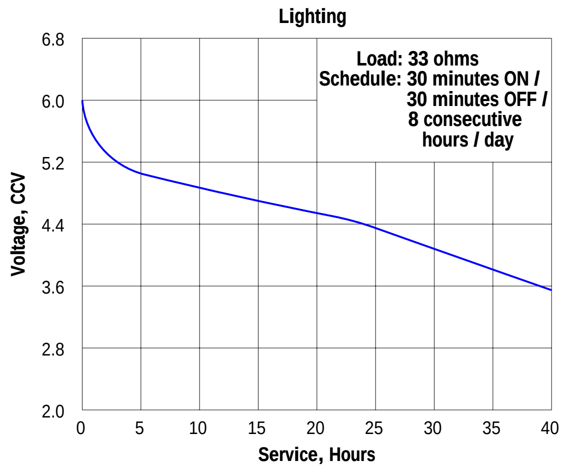


EVEREADY NO. 510S

TYPICAL APPLICATIONS







INTERNAL RESISTANCE VS TEMPERATURE This measurement is an approximation of the battery's actual internal resistance. It is sensitive to the loads selected and operator technique.

Schedule: Background Load 600 ohms, Pulse Load 10 ohms, Pulse Duration 1 second.

Temperature	Typical Ri (ohms)
45°C (113°F)	0.7
21°C (70°F)	0.8
0°C (32°F)	1.0
-20°C (-4°F)	10.0

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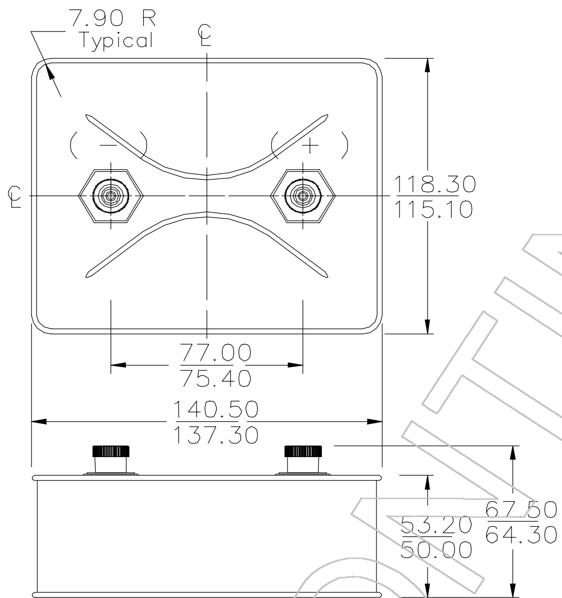
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 520



Chemical System: Alkaline-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-930A, IEC-4LR20-2
Typical Weight: 1.12 kilograms (39.51 oz.)
Volume: 883 cubic centimeters (53.9 cubic in.)
Cells: Four No. 3-361 in series
Jacket: Metal
Terminals: Insulated Knurl / Screw Post

Dimensions (mm)

Millimeters	Inches
7.90	0.311
50.00	1.969
53.20	2.094
64.30	2.531
67.50	2.657
75.40	2.969
77.00	3.031
115.10	4.531
118.30	4.657
137.30	5.406
140.50	5.531

IMPORTANT NOTICE

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Eveready Battery Company, Inc.

533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

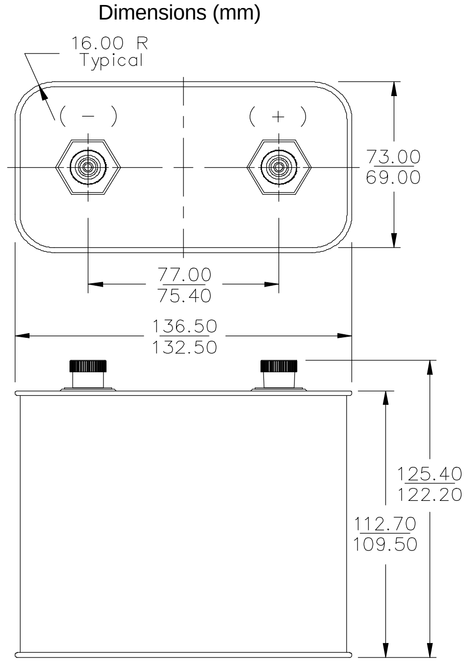
Engineering Data

Alkaline **6V**
No Added Mercury or Cadmium

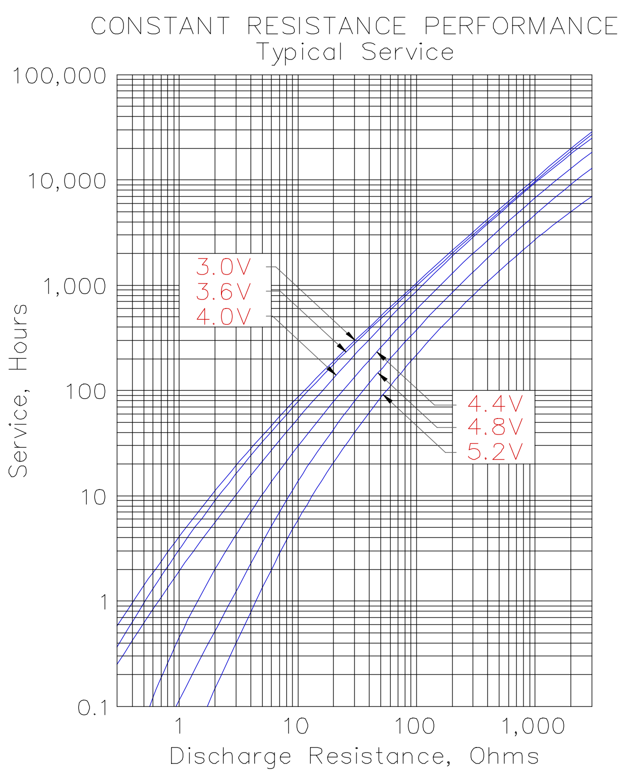
ENERGIZER NO. 521

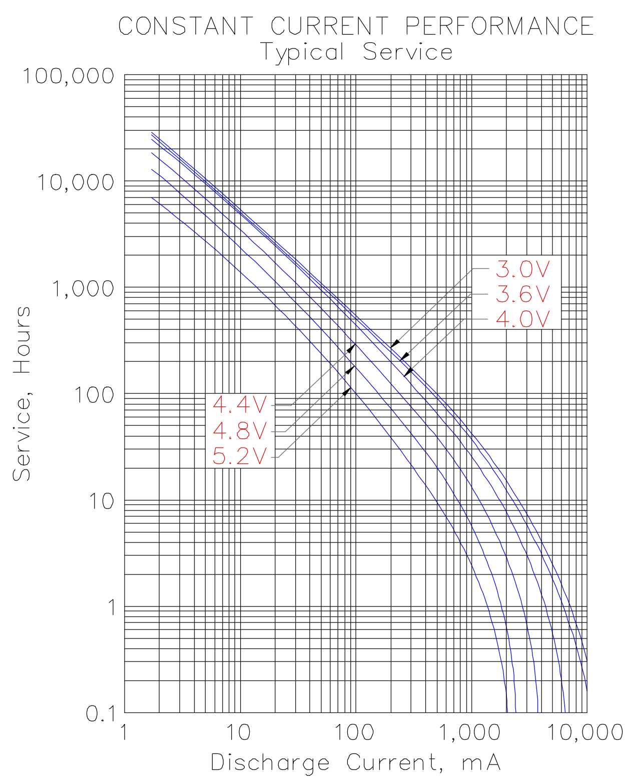
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-918A, IEC-4LR25-2
Battery Voltage: 6 Volts
Terminal: Plastic Knurl / Screw Post
Average Weight: 1.9 kilograms (67.3oz.)
Volume: 1123 cubic centimeters (68.5 cubic inch)
Average Service capacity (to 0.8Volts / cell): 52 Ah
(Rated Capacity at 25 mA continuous drain)
Cell: Eight No. 3-361Two parallel strings of four in series
Jacket: Metal

Dimensions (mm)

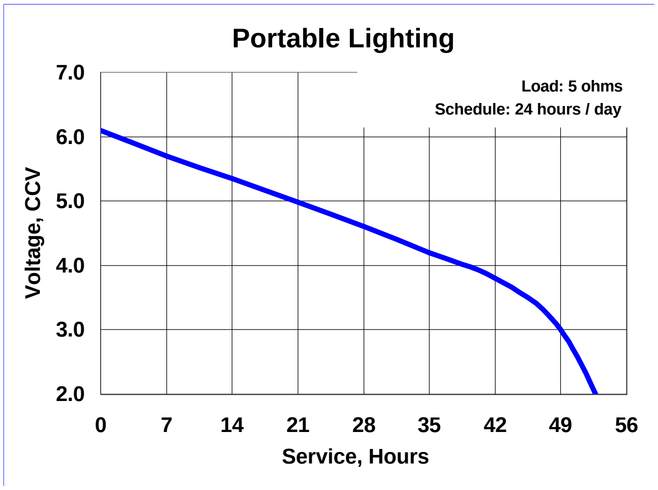


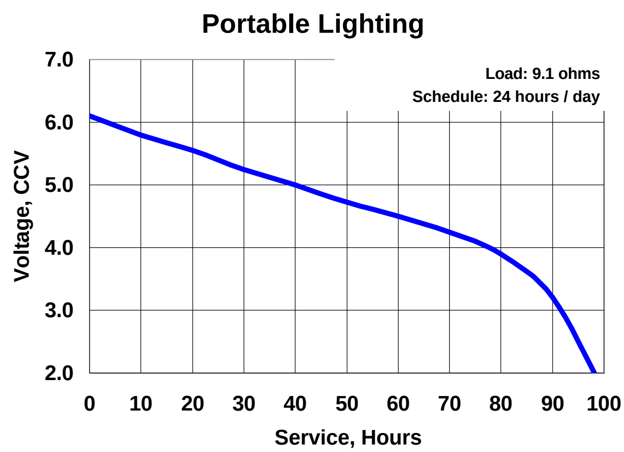
Millimeters	Inches
16.00	0.630
69.00	2.717
73.00	2.874
75.40	2.969
77.00	3.031
109.50	4.311
112.70	4.437
122.20	4.811
125.4	4.937
132.5	5.217
136.5	5.374





Typical Applications





Important Notice

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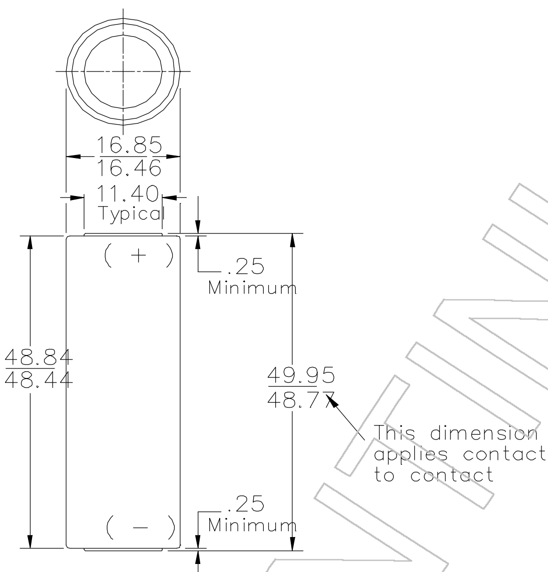
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 523



Chemical System:Alkaline-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-1306AP, IEC-3LR50
Typical Weight: 31 grams (1.09 oz.)
Volume: 11 cubic centimeters (0.67 cubic in.)
Cells: Three No. 3-0663 in series
Jacket: Metal
Terminals: Flat contact

Dimensions (mm)

Millimeters	Inches
0.25	0.010
11.40	0.449
16.46	0.648
16.85	0.663
48.44	1.907
48.77	1.920
48.84	1.923
49.95	1.966

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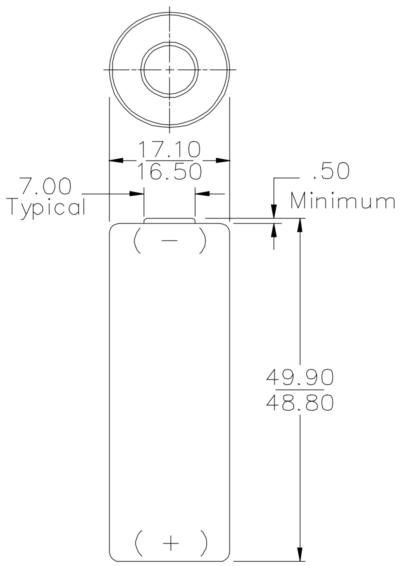
Eveready Battery Company, Inc.

533 Maryville University Dr.
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Alkaline ***4.5V***
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EN133A

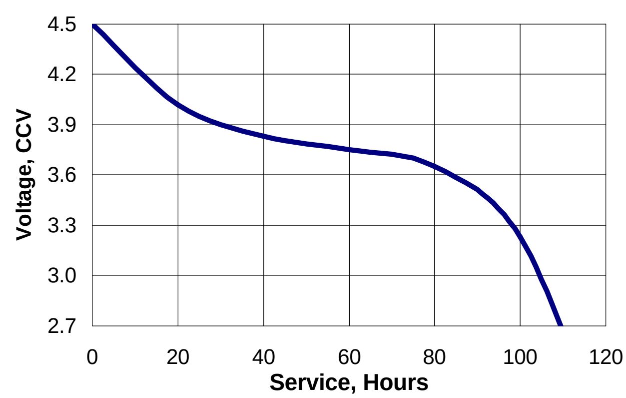


Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-1306A, IEC-3LR50
Battery Voltage: 4.5 Volts
Typical Weight: 27 grams (1.0 oz.)
Volume: 11.4 cubic centimeters (0.7 cubic inch)
Average Service capacity (to 2.7 Volt): 650 mAh
(Rated Capacity at 650 ohms continuous at 20^{o}C)
Cell: Three No 1A-P in series

Dimensions (mm)

Millimeters	Inches
0.50	0.020
7.00	0.276
16.50	0.650
17.10	0.673
48.80	1.921
49.90	1.965

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21^{o}C (70^{o}F)



SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains 3.75V (milliamperes)	Load (ohms)	Cutoff Voltage 2.7V hours
24 hours / day	5.7	650	114

IMPORTANT NOTICE

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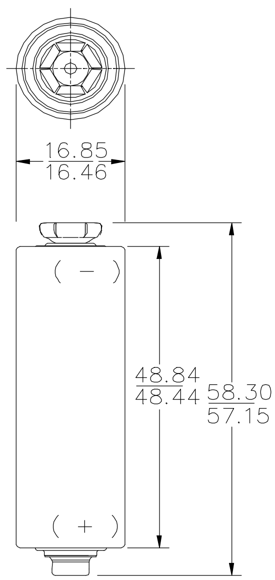
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 531



Chemical System: Alkaline-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-1307AP, IEC-3LR50
Typical Weight: 32.5 grams (1.15 oz.)
Volume: 11.5 cubic centimeters (0.7 cubic in.)
Cells: Three No. 3-0663 in series
Jacket: Metal
Terminals: ANSI Miniature Snap

Dimensions (mm)

Millimeters	Inches
16.46	0.648
16.85	0.663
48.44	1.907
48.84	1.923
57.15	2.250
58.30	2.295

IMPORTANT NOTICE

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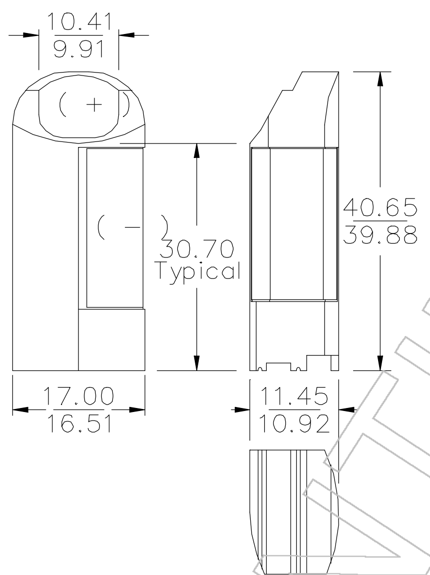
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 538



Chemical System: Manganese Dioxide (MnO_2)
Designation: ANSI / NEDA-1313AP,
Voltage: 4.5 Volts
Typical Capacity (to 2.7V): 165 mAh
(Rated capacity at 2.5K ohms continuous at 21^{o}C)
Typical Weight: 12.2 grams (.43 oz.)
Volume: 7.4 cubic centimeters (0.45 cubic in.)
Cells: Three No. 1522 in series
Jacket: Plastic

Dimensions (mm)

Millimeters	Inches
9.91	0.390
10.41	0.410
10.92	0.430
11.45	0.451
16.51	0.650
17.00	0.669
30.70	1.210
39.88	1.570
40.65	1.600

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Eveready Battery Company, Inc.

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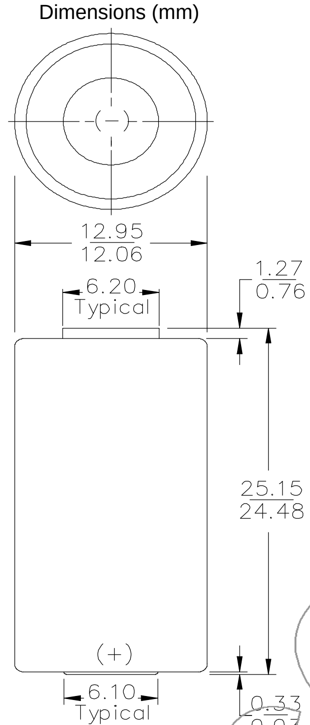
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 544

Dimensions (mm)

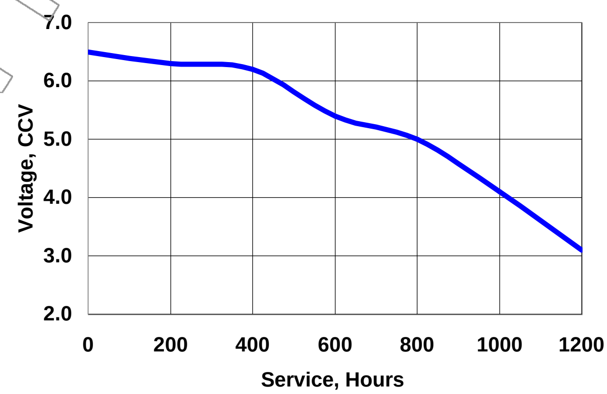


Millimeters	Inches
0.03	0.001
0.33	0.013
0.76	0.030
1.27	0.050
6.10	0.240
6.20	0.244
12.06	0.475
12.95	0.510
24.48	0.964
25.15	0.990

Chemical System: Silver Oxide (Zn/Ag_2O)

Designation: ANSI / NEDA-1406SOP, IEC-4SR44
Battery Voltage: 6.2 Volts
Average Weight: 14.2 grams (0.50 oz.)
Volume: 3.2 cubic centimeters (0.20 cubic inch)
Average Service capacity (to 3.6 Volt): 200 mAh
(Rated Capacity at 30k ohms continuous at 21°C)
Cell: Four EPX76 in series

Typical Discharge Characteristics
Simulated Test at 21ºC (70ºF)



DESIGNED FOR GENERAL ELECTRONICS APPLICATION WHICH MAY REQUIRE HIGH RATE PULSE

Simulated Application Tests
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 5.50V (milliamperes)	Load (ohms)	Cutoff Voltage 3.6V
			hours
24 hours / day	**0.183**	**30,000**	**1,085**

Internal Resistance Closed circuit voltage no less than 4.20 volts on a load of 400 ohms at 21°C (70°F) for 0.1 to 2.0 seconds.

Important Notice

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Energizer

Eveready Battery Company, Inc.

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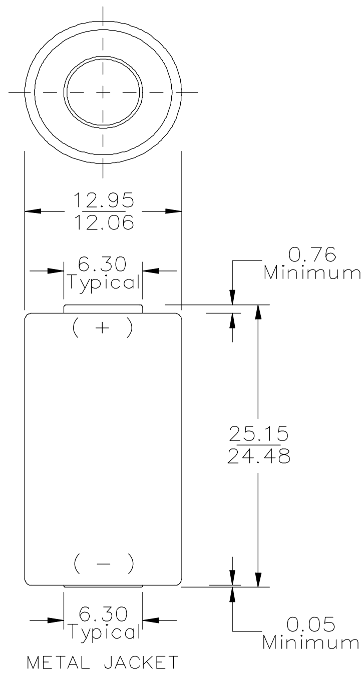
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. A544

Dimensions (mm)

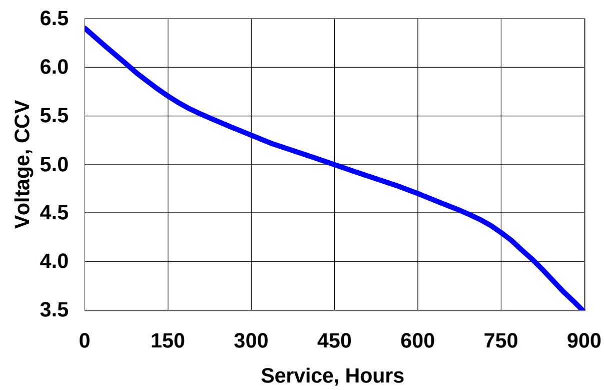


Millimeters	Inches
0.05	0.002
0.76	0.030
6.30	0.248
12.06	0.475
12.95	0.510
24.48	0.964
25.15	0.990

Chemical System: Manganese Dioxide (MnO_2)

Designation: ANSI / NEDA-1414A IEC-4LR44
Battery Voltage: 6.0 Volts
Average Weight: 11.0 grams (0.39 oz.)
Volume: 3.3 cubic centimeters (0.20 cubic inch)
Average Service capacity (to 3.6 Volt): 150 mAh
(Rated Capacity at 30k ohms continuous at 21°C)
Cell: Four A76 in series

Typical Discharge Characteristics
Simulated Test at 21ºC (70ºF)



DESIGNED SPECIFICALLY FOR PHOTO USE

Simulated Application Tests
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 5.0V (milliamperes)	Load (ohms)	Cutoff Voltage 3.6V
			hours
24 hours / day	**0.16**	**30,000**	**892**

Internal Resistance Closed circuit voltage no less than 3.4 volts on a load of 25 ohms at 21°C (70°F) for 0.1 to 2.0 seconds.

Important Notice

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Form No. EBC - 4409B

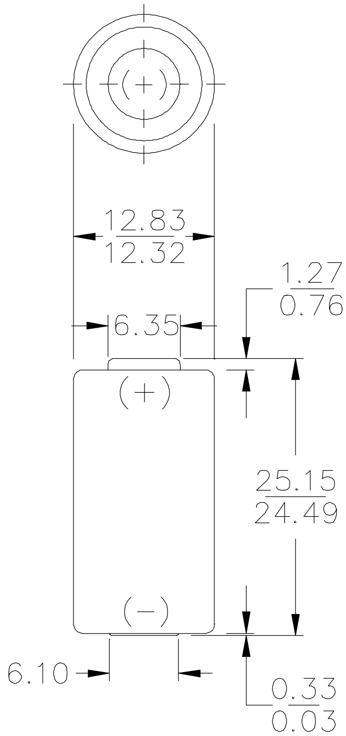
Eveready Battery Company, Inc.

533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. L544

Dimensions (mm)

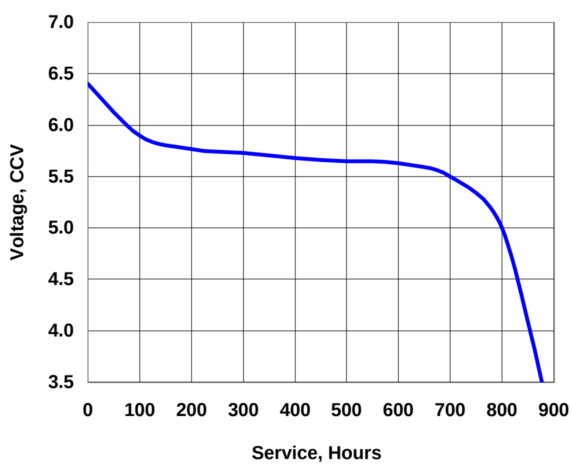


Millimeters	Inches
0.03	0.001
0.33	0.013
0.76	0.030
1.27	0.050
6.10	0.240
6.35	0.250
12.32	0.485
12.83	0.505
24.49	0.964
25.15	0.990

Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

Designation: IEC - 2CR11108
Battery Voltage: 6 Volts
Average Weight: 9 grams (0.3 oz.)
Volume: 3.3 cubic centimeters (0.2 cubic inch)
Average Service Capacity (to 4.0 Volt): 160 mAh
(Rated Capacity at 30k ohms at 21°C)
Max. reverse Charging Current: 1 microampere
(Circuit to Limit Charging Through Reverse Leakage Current)
Recommended Maximum Discharge Current:
60 mA continuous - 80 mA pulse
Cells: 2-1/3N-P

Typical Discharge Characteristics
Simulated Test at 21ºC (70ºF)



Simulated Application Tests
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains at 5.6V (microamperes)	Load (ohms)	Cutoff Voltage 4.0 V Hours
24 hours / day	186	30,000	860

INTERNAL RESISTANCE Close circuit voltage no less than 4 volts on a load of 100 ohms at 21ºC (70ºF) for 1.0 second.

Important Notice

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

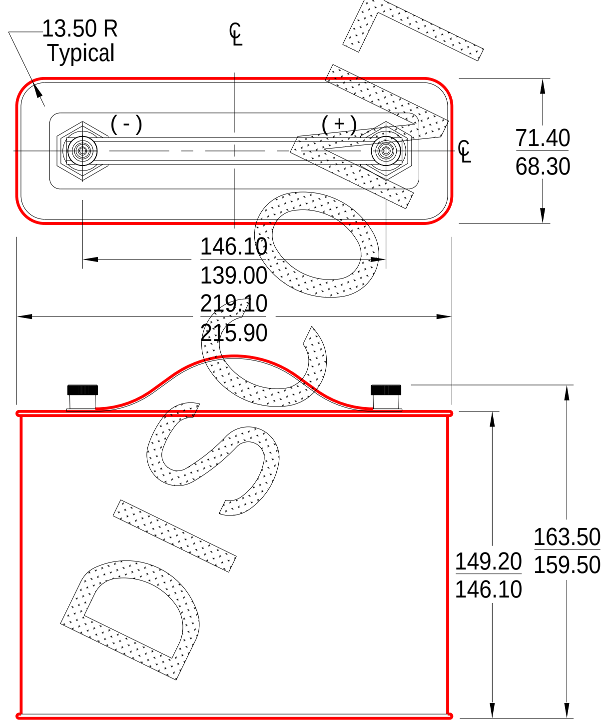
EVEREADY NO. 706

*Zinc Chloride **6V***
No Added Mercury or Cadmium

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-902, IEC-4R25-4
Battery Voltage: 6 Volts
Average Weight: 2.68 kilograms (94.5 oz.)
Volume: 2334 cubic centimeters (142.4 cubic inch)
Cells: Sixteen No. 60 (size "F")-Four parallel strings of four in series.
Jacket: Metal

Dimensions (mm)



Millimeters	Inches
13.50	.531
68.30	2.689
71.40	2.811
139.00	5.472
146.10	5.752
149.20	5.874
159.50	6.280
163.50	6.437
215.90	8.500
219.10	8.626

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

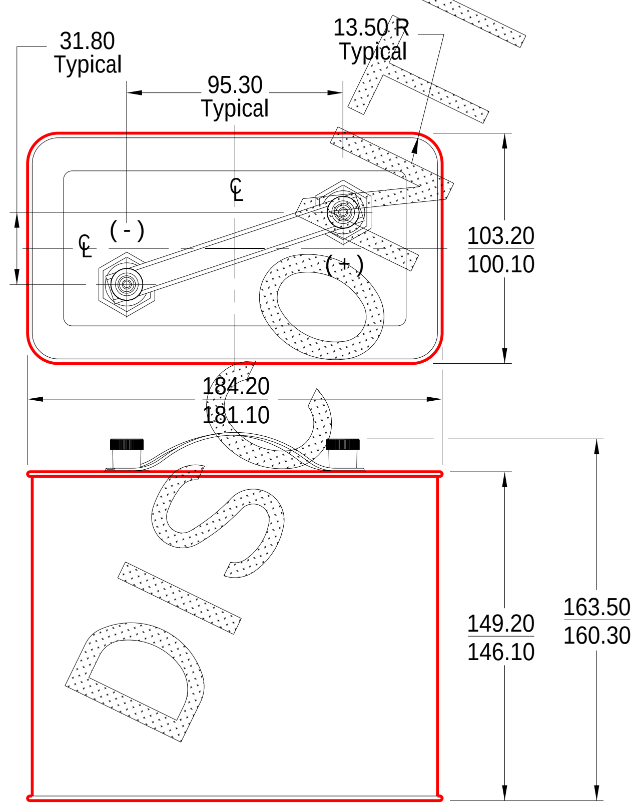
EVEREADY NO. 715

Zinc Chloride ***7.5V***
No Added Mercury or Cadmium

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-903, IEC-5R25-4
Battery Voltage: 7.5 Volts
Average Weight: 3.46 kilograms (122.0 oz.)
Volume: 2836 cubic centimeters (173.0 cubic inch)
Cells: Twenty No. 60 (size "F")-Four parallel strings of five in series.
Jacket: Metal

Dimensions (mm)



Millimeters	Inches
13.50	.531
31.80	1.252
95.30	3.752
100.10	3.941
103.20	4.063
146.10	5.752
149.20	5.874
160.30	6.311
163.50	6.437
181.10	7.130
184.20	7.252

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

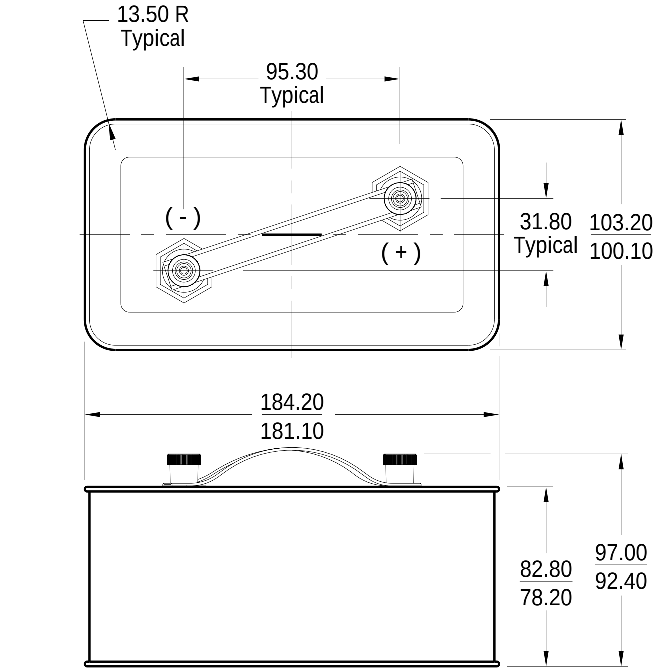
Engineering Data

EVEREADY NO. EN715

Alkaline ***1.5V***
INDUSTRIAL
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

Chemical System: Alkaline-Manganese Dioxide ($Zn/Mn0_2$)

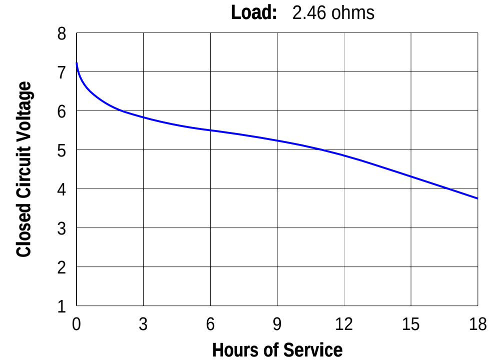
Designation: ANSI / NEDA-903AC, IEC-5LR25-2
Battery Voltage: 7.5 Volts
Average Weight: 2.3 Kilograms (81.4 oz.)
Volume: 1570 cubic centimeters (95.8 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 43 Ah
(Rated capacity at 25 mA continuous drain)
Cell: Ten No. 3-361- Two parallel strings of five in series.
Jacket: Metal



Dimensions (mm)

Millimeters	Inches
13.50	.531
31.80	1.252
78.20	3.079
82.80	3.260
92.40	3.638
95.30	3.752
97.00	3.819
100.10	3.941
103.20	4.063
181.10	7.130
184.20	7.252

TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 24 hours / day
Typical Drain @ 6.0V: 2439 milliamperes
Load: 2.46 ohms



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 6.0V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 3.25V (hours)	3.75V	4.5V	5.0V	5.5V	6.0V
30 minutes ON 30 minutes OFF 8 hours / day	750	8	68	62	52	46	37	19
24 hours / day	2439	2.46	-	18	14	11	6	2

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Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

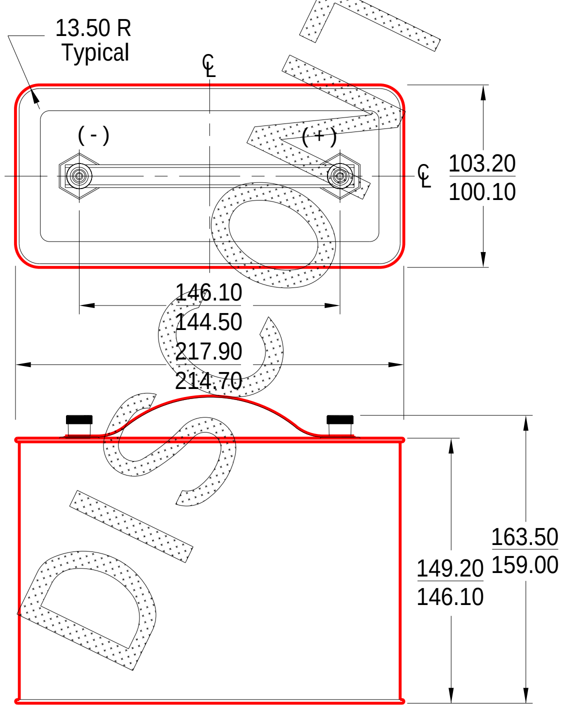
Engineering Data

EVEREADY NO. 716

Zinc Chloride ***9V***
No Added Mercury or Cadmium

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-904, IEC-6R25-4
Battery Voltage: 9 Volts
Average Weight: 3.80 kilograms (134.0 oz.)
Volume: 3355 cubic centimeters (204.7 cubic inch)
Cells: Twenty four No. 60 (size "F")-Four parallel strings of six in series.
Jacket: Metal



Millimeters	Inches
13.50	.531
100.10	3.941
103.20	4.063
144.50	5.689
146.10	5.752
149.20	5.874
159.00	6.260
163.50	6.437
214.70	8.453
217.90	8.579

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

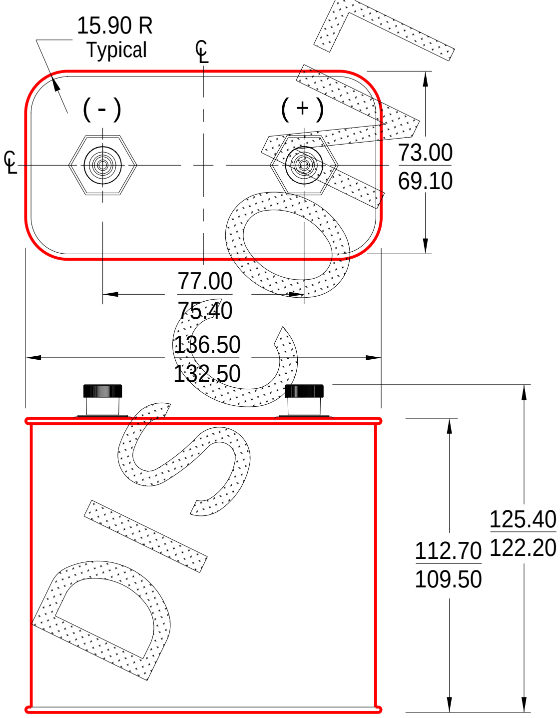
Engineering Data

EVEREADY NO. 731

Zinc Chloride ***6V***
Classic
No Added Mercury or Cadmium

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-918, IEC-4R25-2
Battery Voltage: 6 Volts
Average Weight: 1.25 kilograms (44.1 oz.)
Volume: 1123 cubic centimeters (68.5 cubic inch)
Cells: Eight No. 60 (size "F")-Two parallel strings of four in series.
Jacket: Metal



Millimeters	Inches
15.90	.626
69.10	2.720
73.00	2.874
75.40	2.969
77.00	3.031
109.50	4.311
112.70	4.437
122.20	4.811
125.40	4.937
132.50	5.217
136.50	5.374

Eveready Battery Company, Inc.

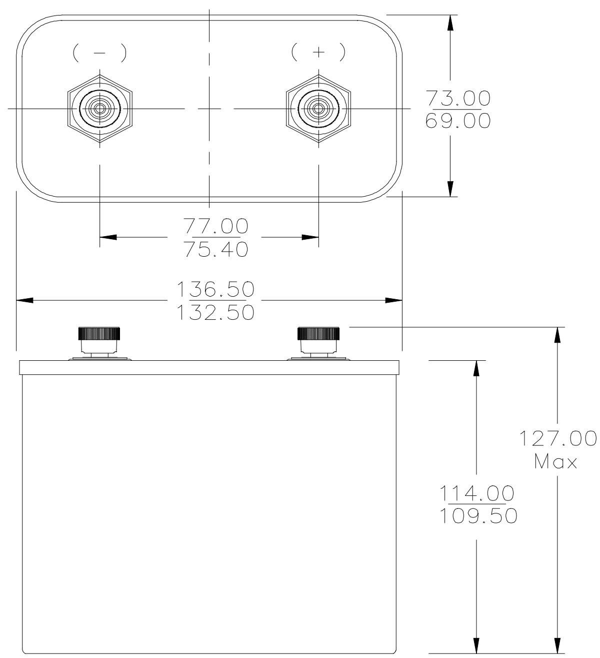
Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Zinc Chloride ***6V***
Industrial Heavy Duty
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EV131

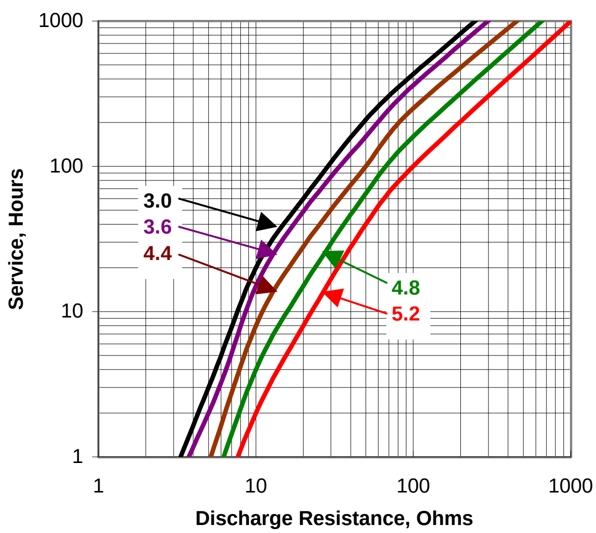
Dimensions (mm)



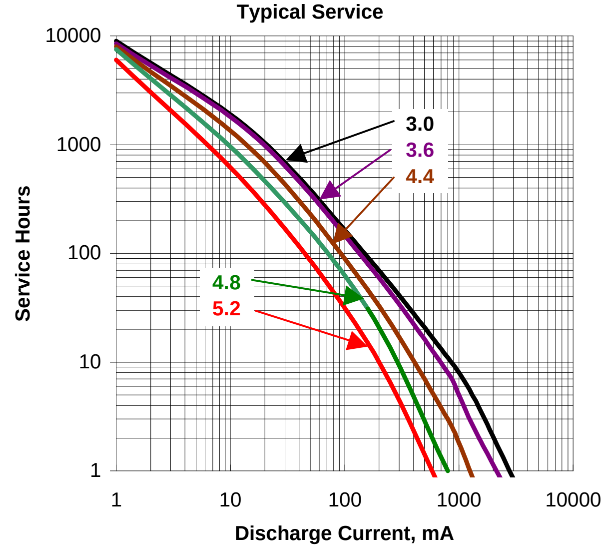
Chemical System:Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI-918CD, IEC-4R25X
Battery Voltage: 6 Volts
Average Weight: 1.25 kilograms (44.1 oz.)
Volume: 1123 cubic centimeters (68.5 cubic inch)
Average Service capacity (to 3.6Volts): 10 Ah
(Rated Capacity at 25 mA continuous drain)
Cell: Eight No. 60 (size “F”)-Two parallel strings of four in series
Terminals: Insulated Knurl / Screw Post
Jacket: Plastic

Millimeters	Inches
69.00	2.717
73.00	2.874
75.40	2.969
77.00	3.031
109.50	4.311
114.00	4.488
127.00	5.000
132.50	5.217
136.50	5.374

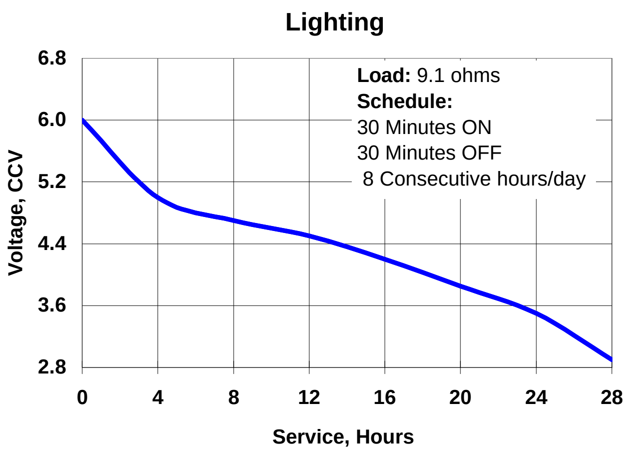
CONSTANT RESISTANCE PERFORMANCE
Typical Service

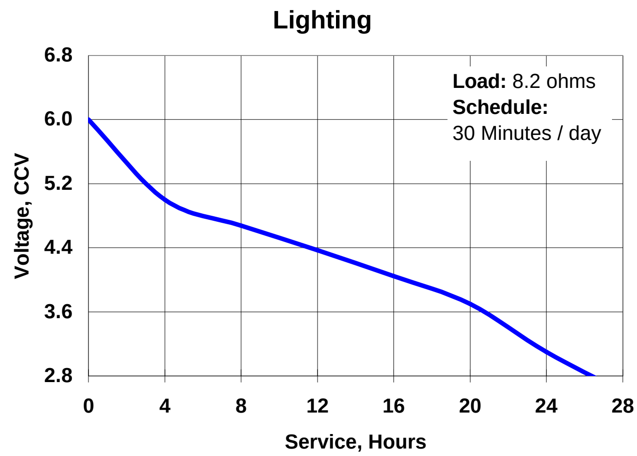


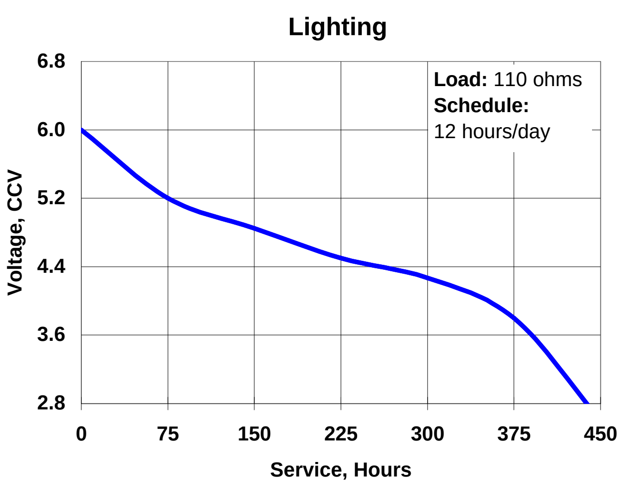
CONSTANT CURRENT DISCHARGE
Typical Service



Typical Applications







INTERNAL RESISTANCE VS. TEMPERATURE
This measurement is an approximation of the battery's actual internal resistance. It is sensitive to the loads and operator technique.

Schedule: Background Load 600 ohms.
Pulse Load 10 ohms.
Pulse Duration 1 second

Temperature	Typical Ri (ohms)
45ºC (113ºF)	1.6
21ºC (70ºF)	0.7
0ºC (32ºF)	0.8
-21ºC (-4ºF)	10

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Eveready Battery Company, Inc.

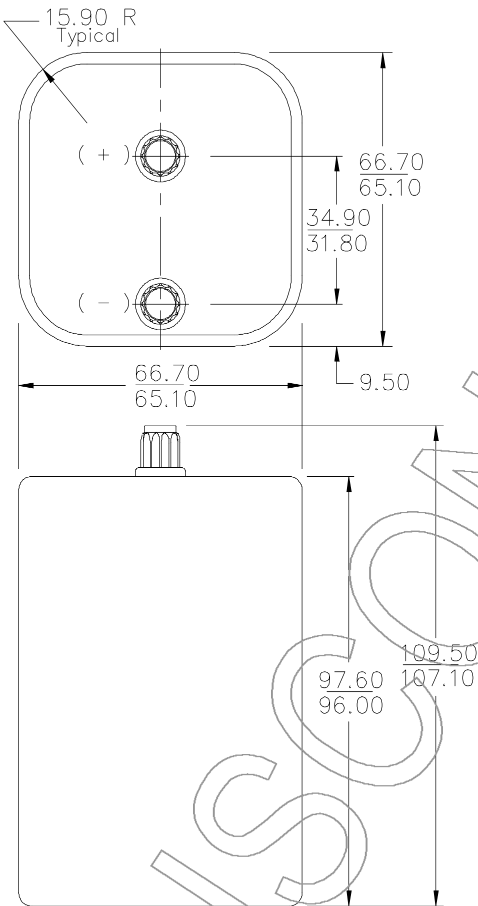
533 Maryville University Dr.
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Zinc Chloride ***1.5V***

ENERGIZER NO. 735

Dimensions (mm)



Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-900, IEC-R25-4
Battery Voltage: 1.5 Volts
Average Weight: 653 grams (23.0 oz.)
Volume: 434 cubic centimeters (26.5 cubic inch)
Cells: Four No. 60 (size "F") in parallel
Jacket: Metal
Average Service capacity (to 0.8 Volts): 44 Ah
(Rated Capacity at 25 mA continuous drain)

Millimeters	Inches
9.50	0.374
15.90	0.626
31.80	1.252
34.90	1.374
65.10	2.563
66.70	2.626
96.00	3.780
97.60	3.843
107.10	4.217
109.50	4.311

Less Than 150 Parts per Million Mercury
Consult Eveready For Current
Zero Added Mercury Status

DISCONTINUED

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Eveready Battery Company, Inc.

533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Alkaline **1.5V**
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

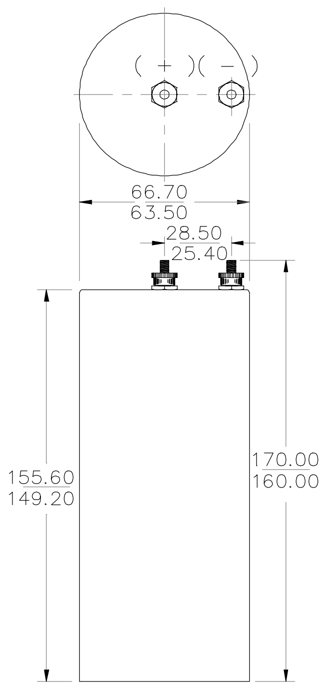
EVEREADY NO. EN6

Chemical System: Alkaline-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-906AC, IEC-LR40
Battery Voltage: 1.5 Volts
Typical Weight: 482 grams (17.1 oz.)
Volume: 594 cubic centimeters (36.2 cubic inch)
Average Service capacity (to 0.8Volts / cell): 52 Ah
(Rated Capacity at 25 mA continuous drain)
Cell: Two No. 3-361 in parallel
Jacket: Plastic Label

Dimensions (mm)

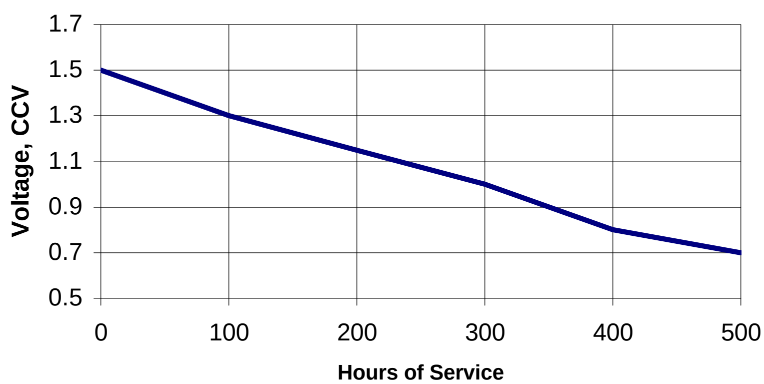
Millimeters	Inches
25.40	1.000
28.50	1.122
63.50	2.500
66.70	2.626
149.20	5.874
155.60	6.126
160.00	6.299
170.00	6.693



SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains 1.2V (milliamperes)	Load (ohms)	Cutoff Voltage 0.85V	0.9V	0.93V
				days	
24 hours / day	4	300		480	
4 minutes / hour 10 hours / day 7 days / week	180	6.67			330
				hours	
24 hours / day	120	10		380	
1 hour / 7hours 1 hour / 17hours	450	2.67		90	

TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 24 hours / day
Typical Drain at 1.2V: 120 milliamperes
Load: 10 ohms



INTERNAL RESISTANCE vs. TEMPERATURE
This measurement is an approximation of the battery's actual internal resistance. It is sensitive to the loads selected and operator technique.
SCHEDULE:
Background load 40 ohms, Pulse load 1.0 ohm, Pulse duration 1

Temperature	Typical Ri (ohms)
21ºC (70ºF)	0.1
0ºC (32ºF)	0.2
-20ºC (-4ºF)	1.0

Important Notice

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Form No. EBC - 1209B

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

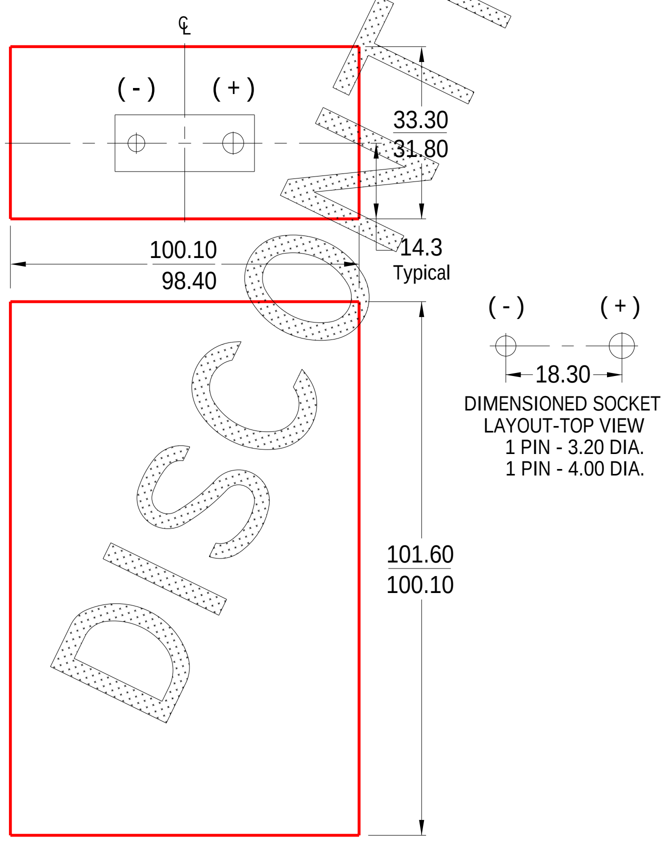
Engineering Data

EVEREADY NO. 736

Zinc Chloride ***4.5V***
No Added Mercury / Cadmium

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-3, IEC-3R25
Battery Voltage: 4.5 Volts
Average Weight: 455 grams (16.0 oz.)
Volume: 339 cubic centimeters (20.7 cubic inch)
Cells: Three No. 60 (size "F") in series.



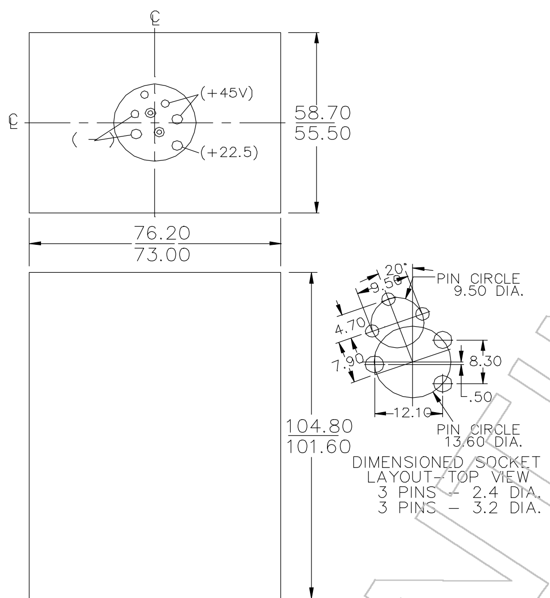
Millimeters	Inches
3.20	.126
4.00	.157
14.30	.563
18.30	.720
31.80	1.252
33.30	1.311
98.40	3.874
100.10	3.941
101.60	4.000

Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 738



Chemical System:Alkaline-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-205, IEC-30R6
Typical Weight: 508 grams (17.9 oz.)
Volume: 469 cubic centimeters (28.6 cubic in.)
Cells: Thirty No. 15 (size "AA") in series
Terminals: Socket

Dimensions (mm)

Millimeters	Inches
0.50	0.020
2.40	0.094
3.20	0.126
4.70	0.185
7.90	0.311
8.30	0.327
9.50	0.374
12.10	0.476
13.60	0.535
55.50	2.185
58.70	2.311
73.00	2.874
76.20	3.000
101.60	4.000
104.80	4.126

IMPORTANT NOTICE

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Eveready Battery Company, Inc.

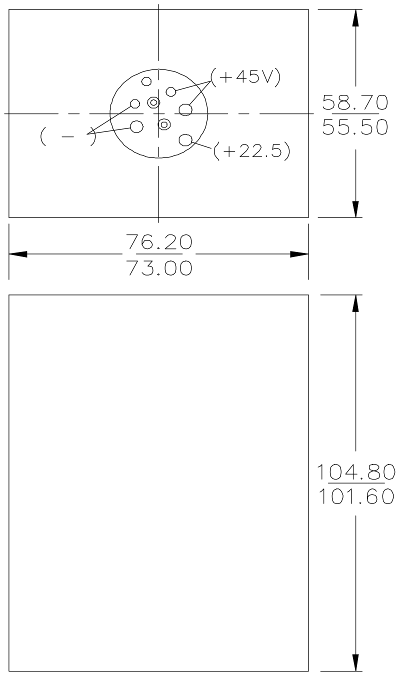
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Leclanche 22.5V, 45V
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

ENERGIZER NO. HS14196

Dimensions (mm)

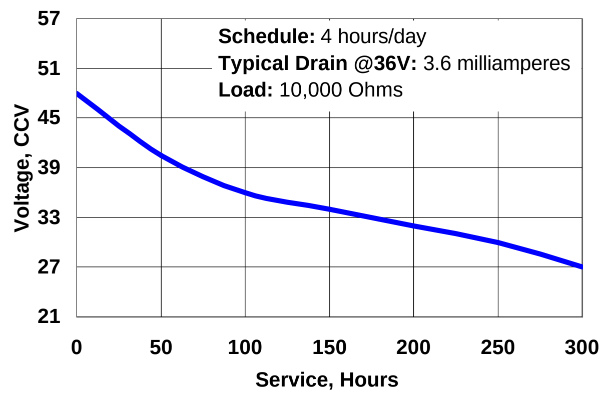


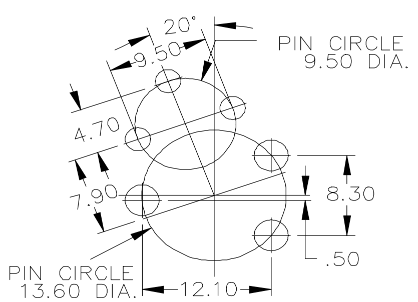
Millimeters	Inches
0.50	0.020
2.40	0.094
3.20	0.126
4.70	0.185
7.90	0.311
8.30	0.327
9.50	0.374
12.10	0.476
13.60	0.535
55.50	2.185
58.70	2.311
73.00	2.874
76.20	3.000
101.60	4.000
104.80	4.126

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-205C, IEC-30R6
Battery Voltage: 22.5, 45 Volts
Average Weight: 508 grams (18 oz.)
Volume: 469 cubic centimeters (28.6 cubic inch)
Average Service capacity (to 1.3 Volt): 950 mAh
(Rated Capacity at 25 mA continuous at 21°C)
Cells: Thirty No. 15 (size "AA") in series
Jacket: Paper

Typical Discharge Characteristics





DIMENSIONED SOCKET
LAYOUT—TOP VIEW
3 PINS – 2.4 DIA.
3 PINS – 3.2 DIA.

Simulated Application Tests

Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 36V (milliamperes)	Load (ohms)	Cutoff Voltage 27V	30V	33V	36V
			hours			
4 hours / day	3.6	10,000	300	255	175	100
4 hours / day	7.2	5,000	140	120	72	50
4 hours / day	14.4	2,500	54	45	27	18

Schedule	Load (ohms)	Cutoff Amperage 2A	2.5A	3A
1 second ON, 4 seconds rest.		days	days	days
1 second ON, 4 seconds rest. 1 second ON, 3 cycles / day intervals of 3, 3, and 18 hours 5 days / week	2	100	90	80

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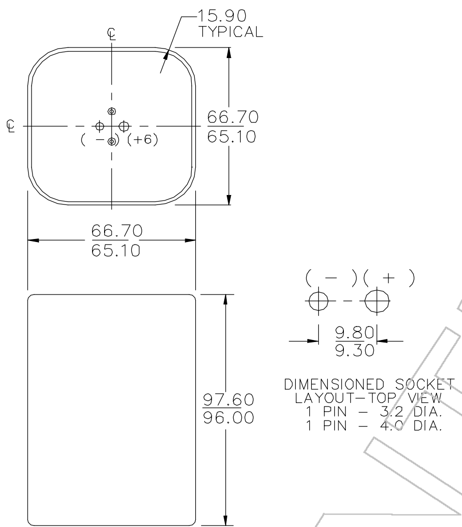
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 744



BATTERY SHALL PASS FREELY THROUGH A CYLINDRICAL TUBE 82.6 DIAMETER X 101.6 LONG.

Chemical System: Zinc Chloride-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-6, IEC-4R25
Typical Weight: 625 grams (22 oz.)
Volume: 434 cubic centimeters (26.5 cubic in.)
Cells: Four No. 60 (size "F") in series
Terminals: Socket
Jacket: Metal

Dimensions (mm)

Millimeters	Inches
3.20	0.126
4.00	0.157
9.30	0.366
9.80	0.386
15.90	0.626
65.10	2.563
66.70	2.626
82.60	3.252
96.00	3.780
97.60	3.843
101.60	4.000

IMPORTANT NOTICE

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Energizer

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

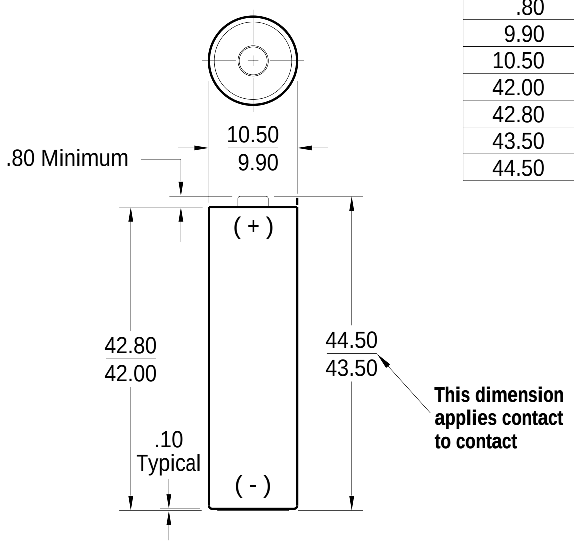
Engineering Data

EVEREADY NO. 1212

AAA
Zinc Chloride ***1.5V***
Super Heavy Duty
No Added Mercury or Cadmium

Dimensions (mm)

Millimeters	Inches
.10	.004
.80	.031
9.90	.390
10.50	.413
42.00	1.654
42.80	1.685
43.50	1.713
44.50	1.752



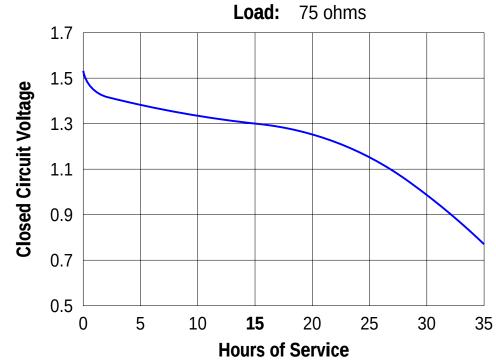
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-24D, IEC-R03
Battery Voltage: 1.5 Volts
Average Weight: 9.7 grams (0.31 oz.)
Volume: 4.0 cubic centimeters (0.2 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 540 mAh
(Rated capacity at 25 mA continuous drain)
Cells: One No. 12 (size "AAA")
Jacket: Metal

SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.2V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 0.75V	0.9V	1.0V	
				hours		
4 hours / day	16	75	35	32	29	
				minutes		
1 hour / day	120	10	210	160	130	
4 minutes / hour 8 hours / day	235	**5.1**	110	90	70	
				pulses		
15 seconds / minute 24 hours / day	333	3.6	240	175	130	

TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 4 hours/day
Typical Drain @ 1.2V: 16 milliamperes
Load: 75 ohms



INTERNAL RESISTANCE VS TEMPERATURE This measurement is an approximation of the battery's actual internal resistance. It is sensitive to the loads selected and operator technique.

Schedule: Background Load 750 ohms, Pulse Load 5.1 ohms, Pulse Duration 1 second.

Temperature	Typical Ri (ohms)
45°C (113°F)	0.5
21°C (70°F)	0.6
0°C (32°F)	0.7
-20°C (-4°F)	10.0

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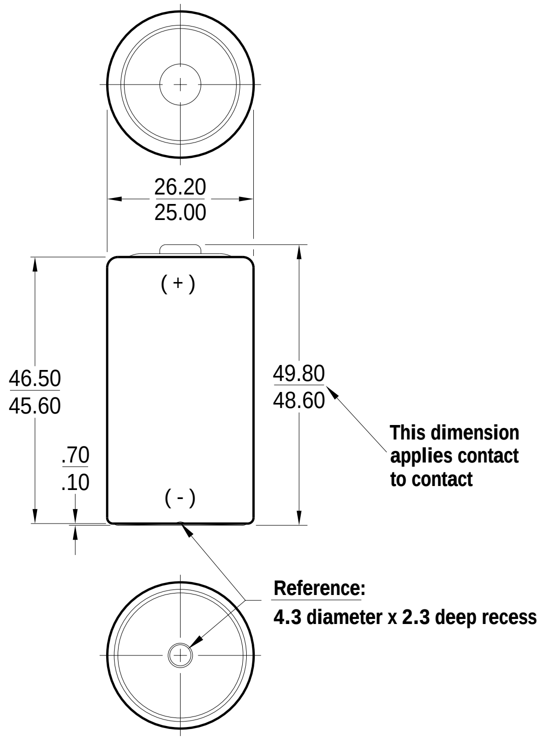
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

C

Zinc Chloride ***1.5V***
Super Heavy Duty
No Added Mercury or Cadmium

EVEREADY NO. 1235



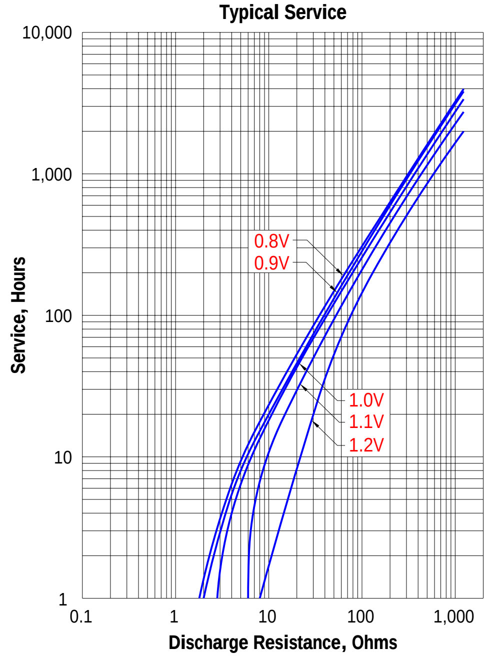
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-14D, IEC-R14
Battery Voltage: 1.5 Volts
Average Weight: 45 grams (1.6 oz.)
Volume: 25 cubic centimeters (1.5 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 3 Ah
(Rated capacity at 25 mA continuous drain)
Cells: One No. 35 (size "C")
Jacket: Plastic Laminated Paper

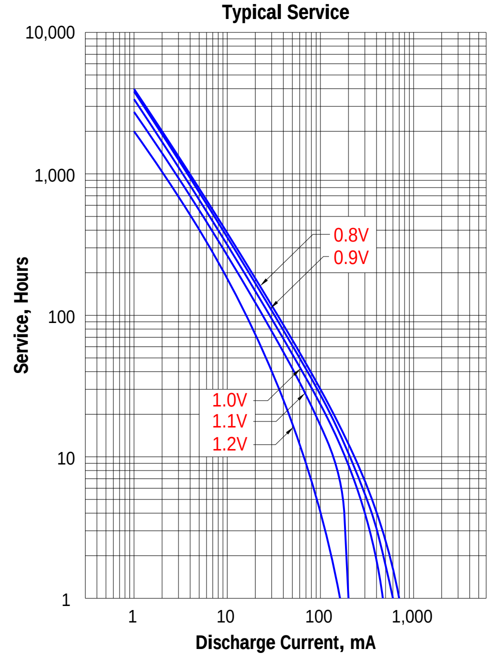
Dimensions (mm)

Millimeters	Inches
.10	.004
.70	.028
2.30	.091
4.30	.169
25.00	.984
26.20	1.031
45.60	1.795
46.50	1.831
48.60	1.913
49.80	1.961

CONSTANT RESISTANCE PERFORMANCE
Typical Service

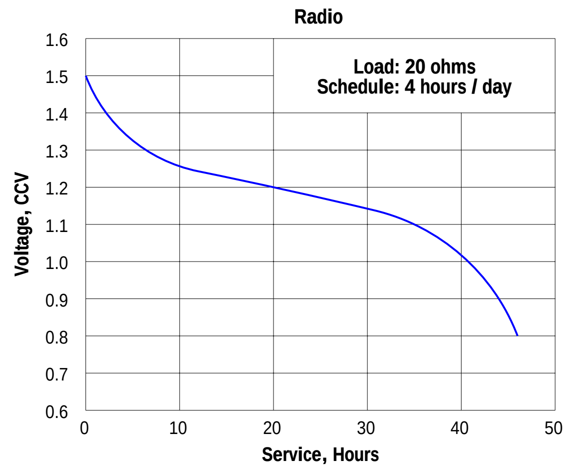


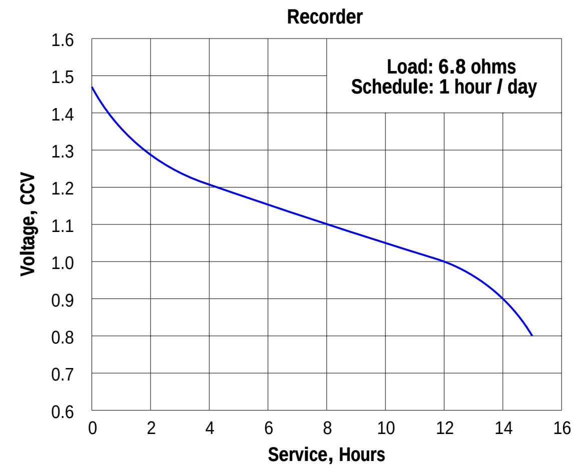
CONSTANT CURRENT PERFORMANCE
Typical Service

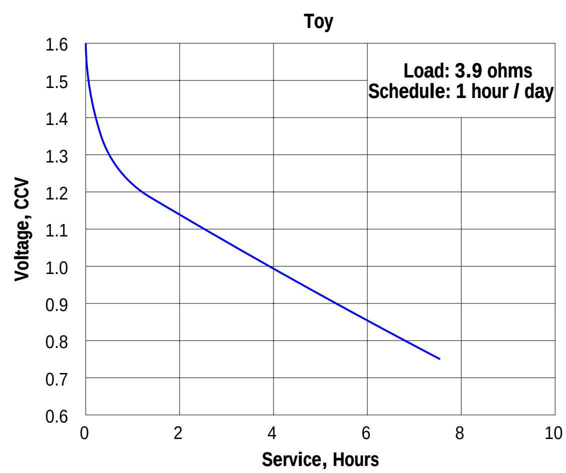


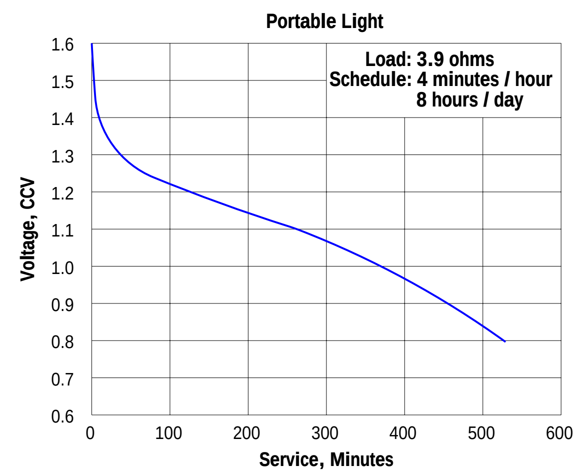
EVEREADY NO. 1235

TYPICAL APPLICATIONS









IMPORTANT NOTICE

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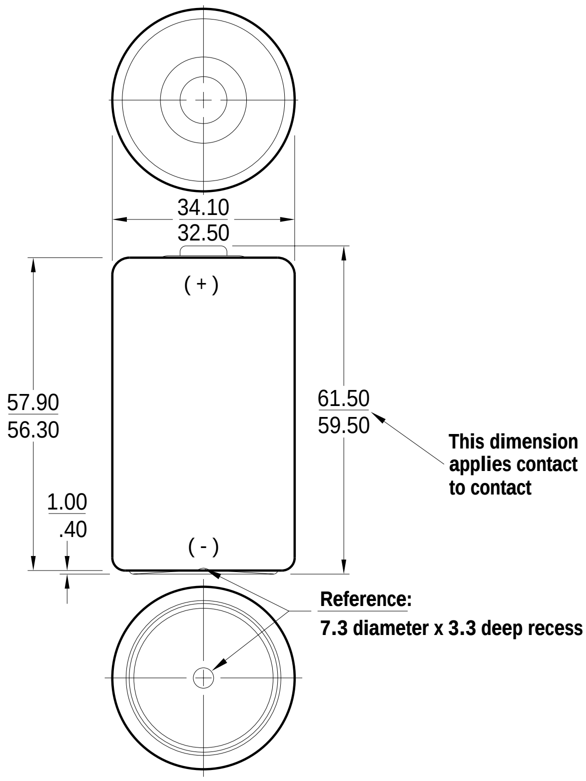
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

_D_
Zinc Chloride ***1.5V***
Super Heavy Duty
No Added Mercury or Cadmium

EVEREADY NO. 1250



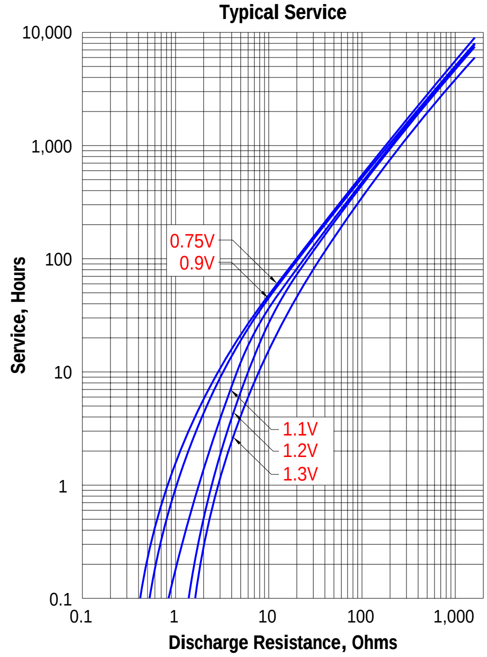
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-13D, IEC-R20
Battery Voltage: 1.5 Volts
Average Weight: 89 grams (3.1 oz.)
Volume: 53 cubic centimeters (3.2 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 5.9 Ah
(Rated capacity at 25 mA continuous drain)
Cells: One No. 50 (size "D")
Jacket: Plastic Laminated Paper

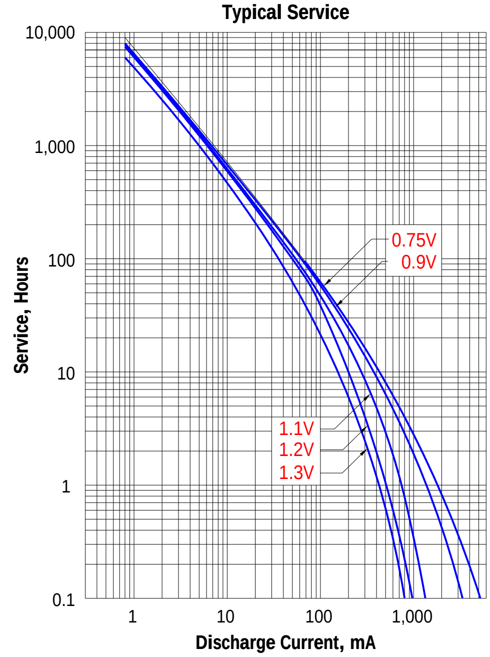
Dimensions (mm)

Millimeters	Inches
.40	.016
1.00	.039
3.30	.130
7.30	.287
32.50	1.280
34.10	1.343
56.30	2.217
57.90	2.280
59.50	2.343
61.50	2.421

CONSTANT RESISTANCE PERFORMANCE
Typical Service

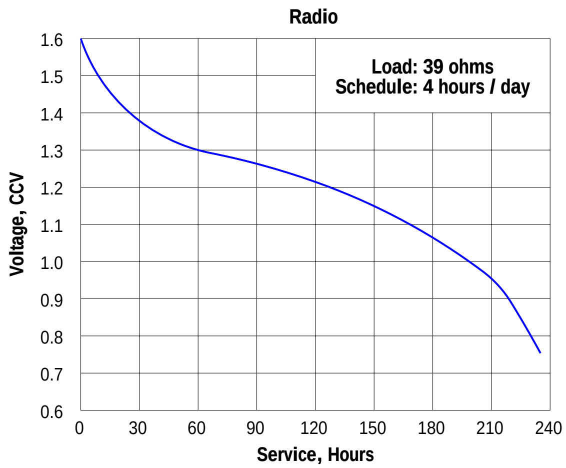


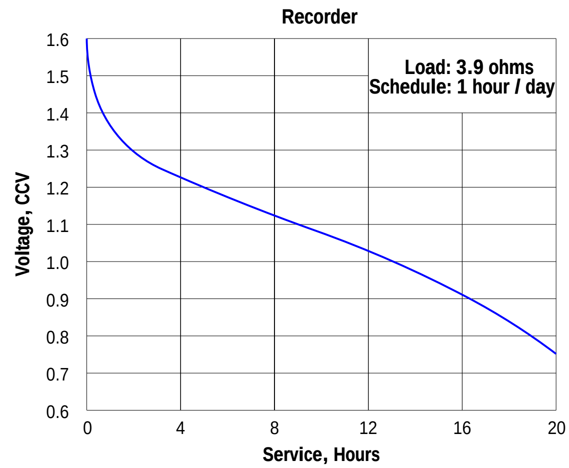
CONSTANT CURRENT PERFORMANCE
Typical Service

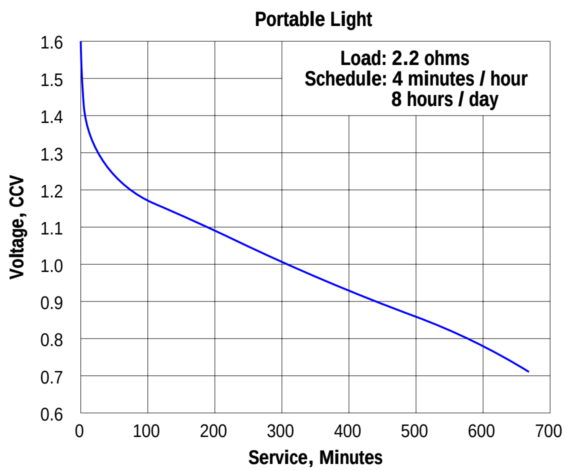


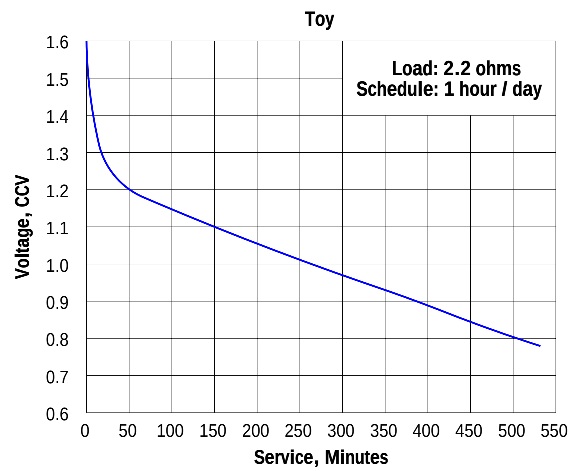
EVEREADY NO. 1250

TYPICAL APPLICATIONS









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Eveready Battery Company, Inc.

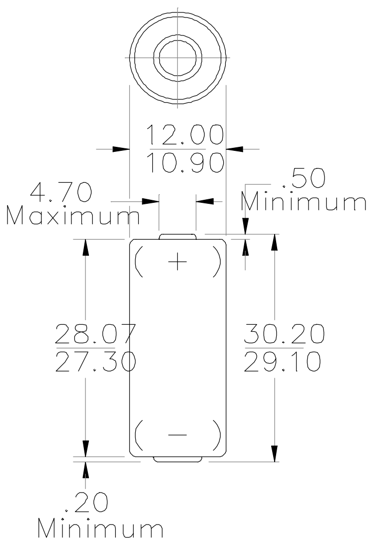
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

N
Alkaline **1.5V**
No Added Mercury or Cadmium

ENERGIZER NO. E90

Dimensions (mm)

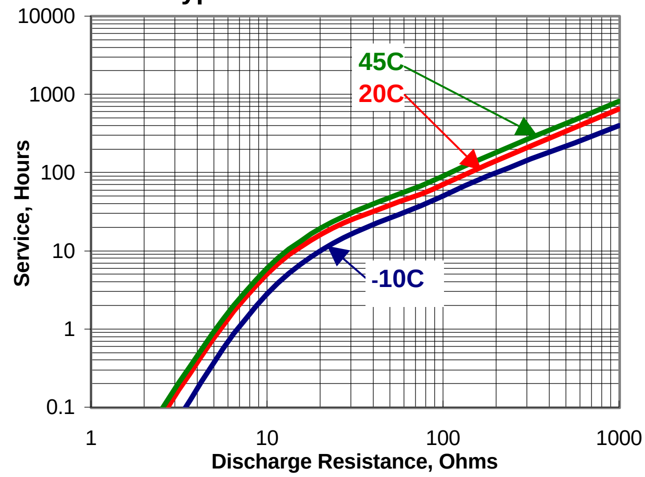


Millimeters	Inches
0.20	0.008
0.50	0.020
4.70	0.185
10.90	0.429
12.00	0.472
27.30	1.075
28.07	1.105
29.10	1.146
30.20	1.189

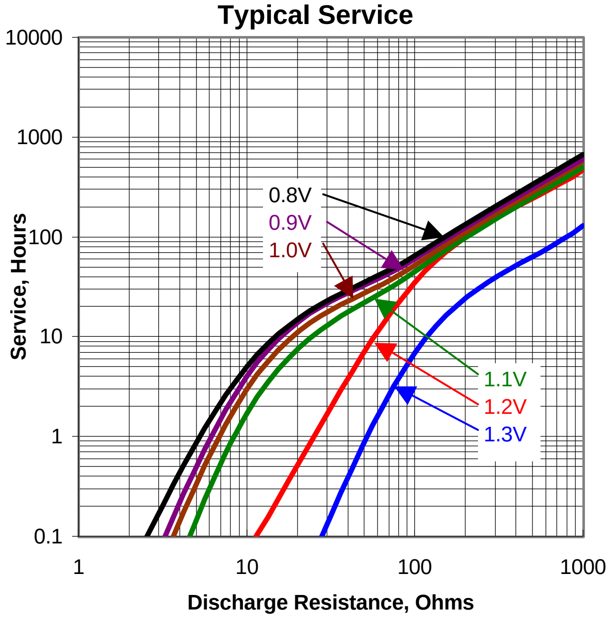
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-910A, IEC-LR1
Battery Voltage: 1.5 Volts
Average Weight: 9.0 grams (0.3oz.)
Volume: 3.3 cubic centimeters (0.2 cubic inch)
Average Service capacity (to 0.8Volts / cell): 1000 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 3-0411 (size "N")
Jacket: Plastic Label

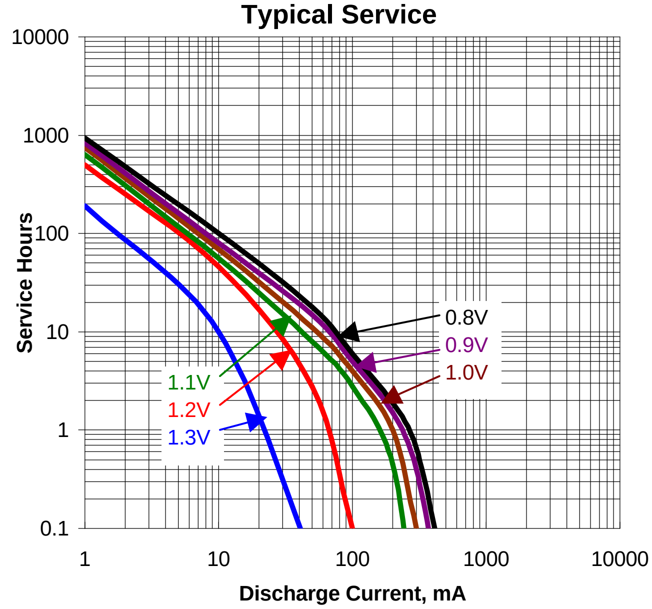
Temperature Effects
Typical Service to 0.8 Volts

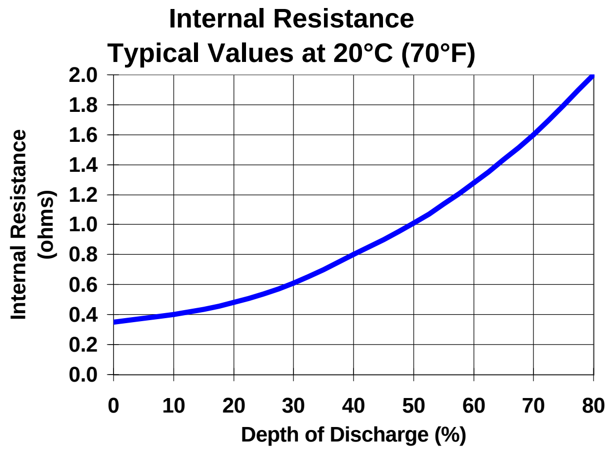


Constant Resistance Performance
Typical Service

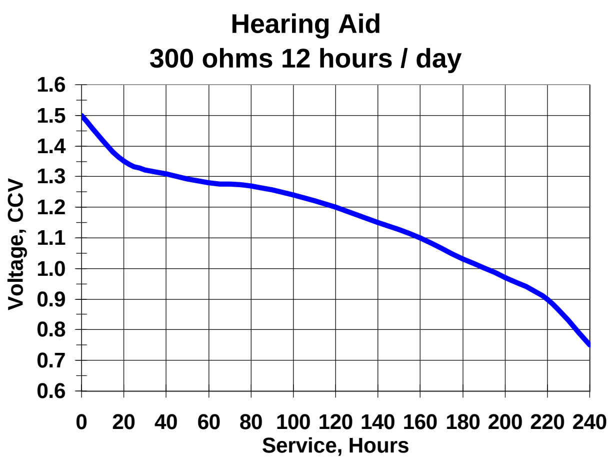


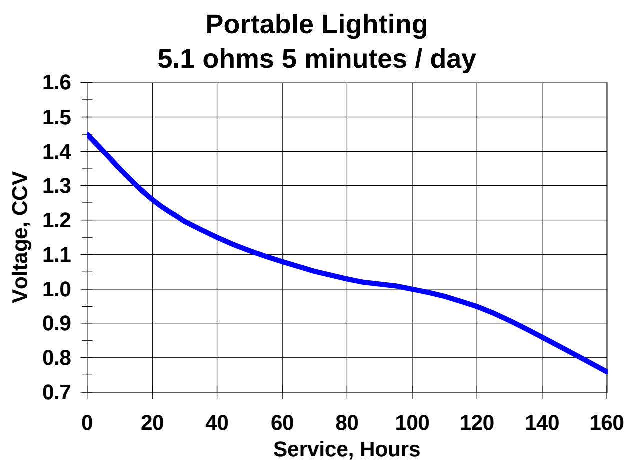
Constant Current Discharge
Typical Service

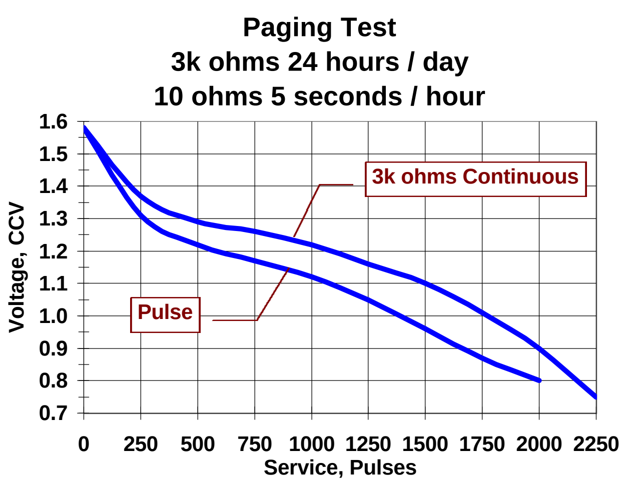




Typical Applications







Important Notice

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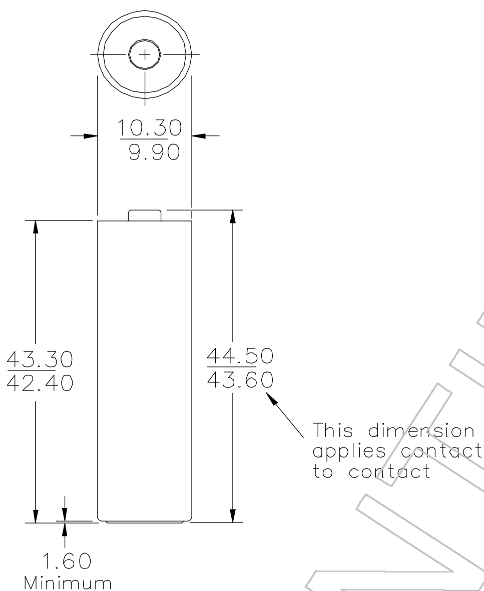
Energizer

Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 912



Chemical System: LeClanche - Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-24F, IEC-R03
Typical Weight: 8 grams (0.3 oz.)
Volume: 4.0 cubic centimeters (0.2 cubic in.)
Cells: One No. 12 (size "AAA")
Terminal: Flat Contact

Dimensions (mm)

Millimeters	Inches
1.60	0.063
9.90	0.390
10.30	0.406
42.40	1.669
43.30	1.705
43.60	1.717
44.50	1.752

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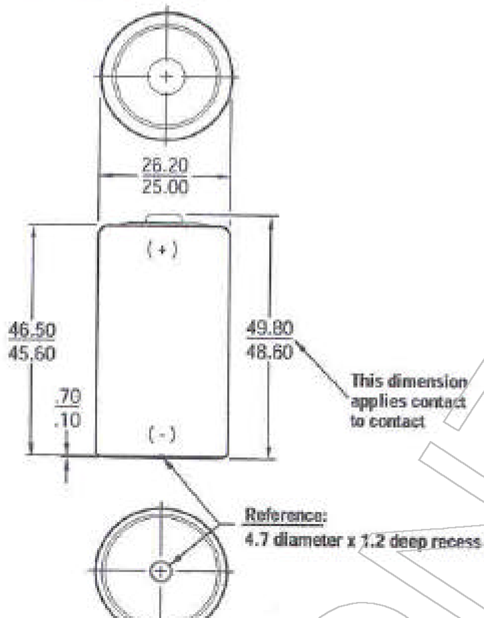
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

C
Zinc Chloride 1.5V
Classic
No Added Mercury or Cadmium

EVEREADY NO. 935

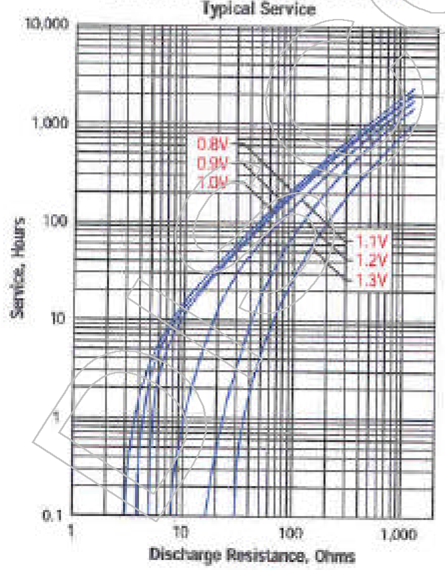


Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI-14F, IEC-R14
Battery Voltage: 1.5 Volts
Average Weight: 41 grams (1.5 oz.)
Volume: 25 cubic centimeters (1.5 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 1.8 Ah
(Rated capacity at 25 mA continuous drain)
Cells: One No. 35 (size "C")
Jacket: Plastic Laminated Paper

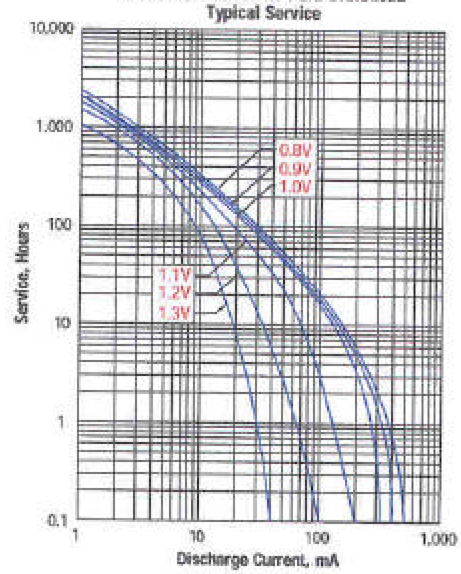
Dimensions (mm)

Millimeters	Inches
.10	.004
.70	.028
1.20	.047
4.70	.185
25.00	.984
26.20	1.031
45.60	1.795
46.50	1.831
48.60	1.913
49.80	1.961

CONSTANT RESISTANCE PERFORMANCE
Typical Service

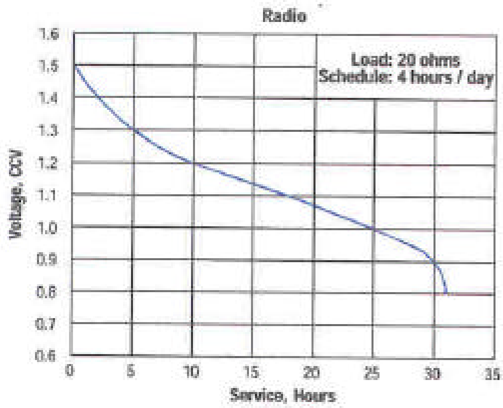


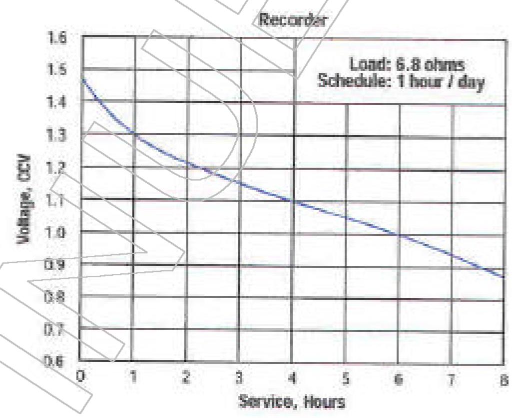
CONSTANT CURRENT PERFORMANCE
Typical Service

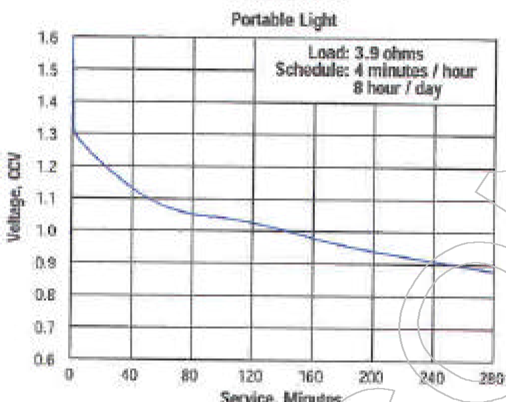


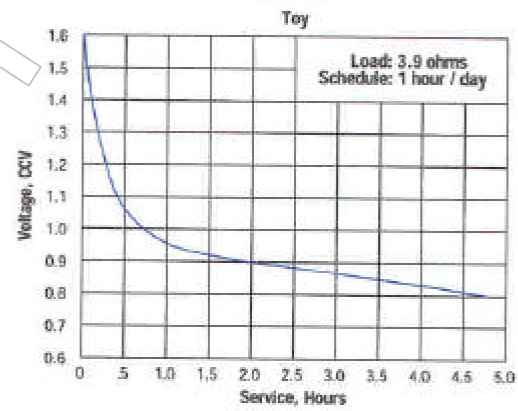
EVEREADY NO. 935

TYPICAL APPLICATIONS









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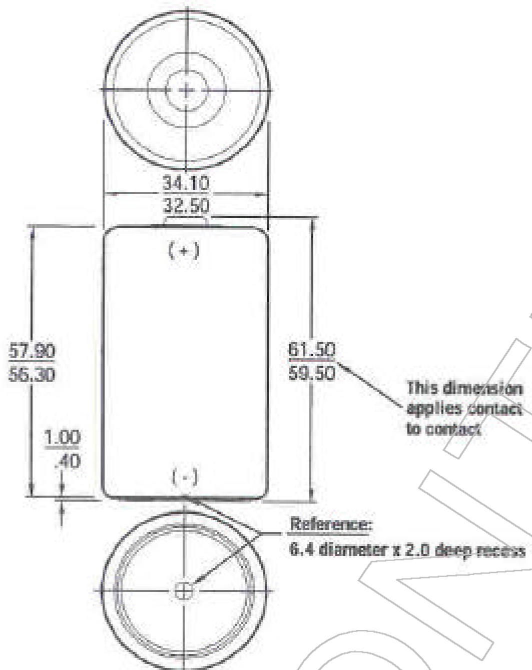
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

D
Zinc Chloride ***1.5V***
Classic
No Added Mercury or Cadmium

EVEREADY NO. 950



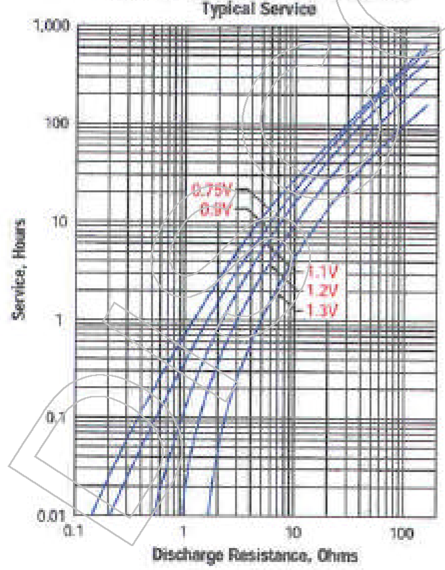
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-13F, IEC-R20
Battery Voltage: 1.5 Volts
Average Weight: 81 grams (2.9 oz.)
Volume: 53 cubic centimeters (3.2 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 4 Ah
(Rated capacity at 25 mA continuous drain)
Cells: One No. 50 (size "D")
Jacket: Plastic Laminated Paper

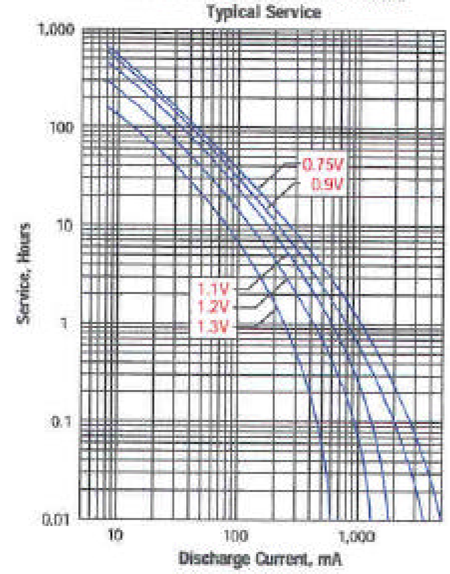
Dimensions (mm)

Millimeters	Inches
.40	.016
1.00	.039
2.00	.079
6.40	.252
32.50	1.280
34.10	1.343
56.30	2.217
57.90	2.280
59.50	2.343
61.50	2.421

CONSTANT RESISTANCE PERFORMANCE
Typical Service



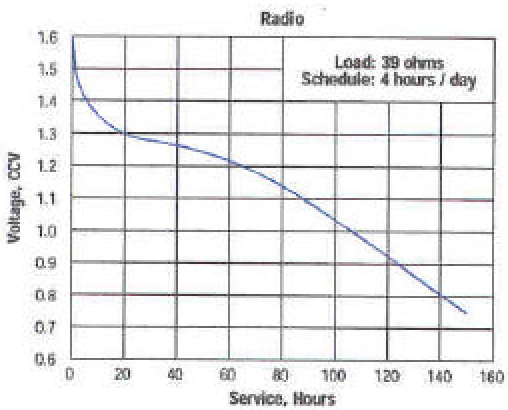
CONSTANT CURRENT PERFORMANCE
Typical Service

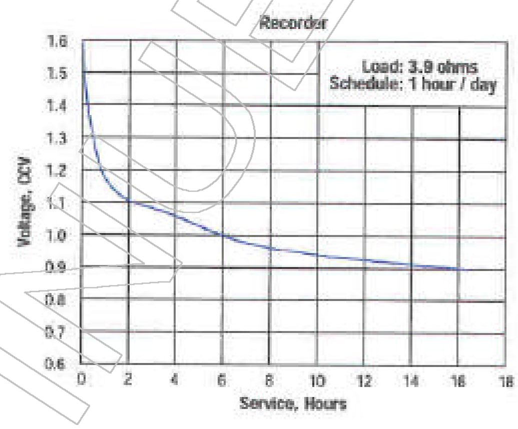


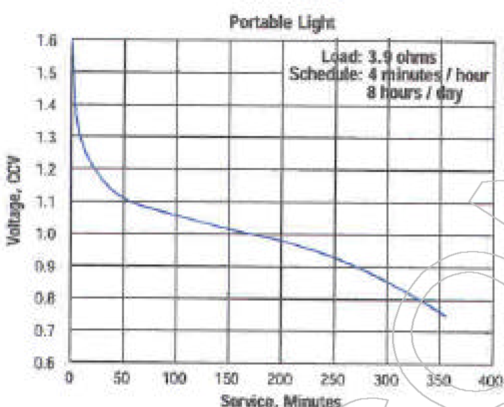
Form No. EPS - 3103B

EVEREADY NO. 950

TYPICAL APPLICATIONS







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Energizer

Eveready Battery Company, Inc.

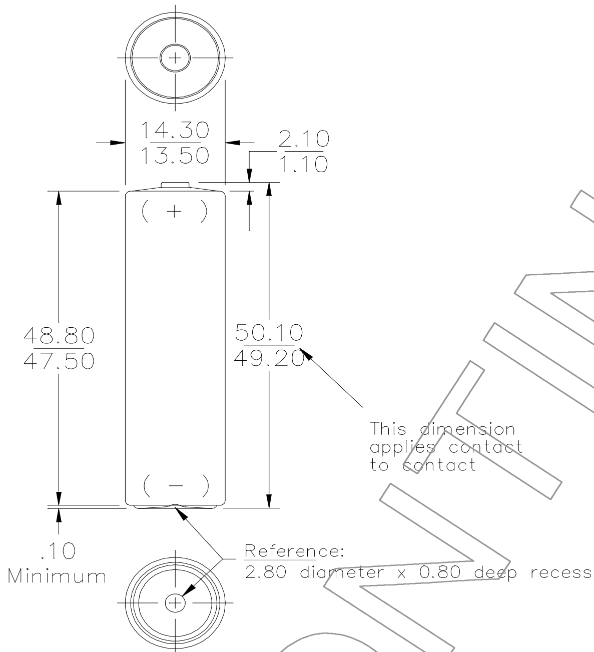
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

AA
Zinc Chloride ***1.5V***
Classic
No Added Mercury or Cadmium

EVEREADY NO. 1015

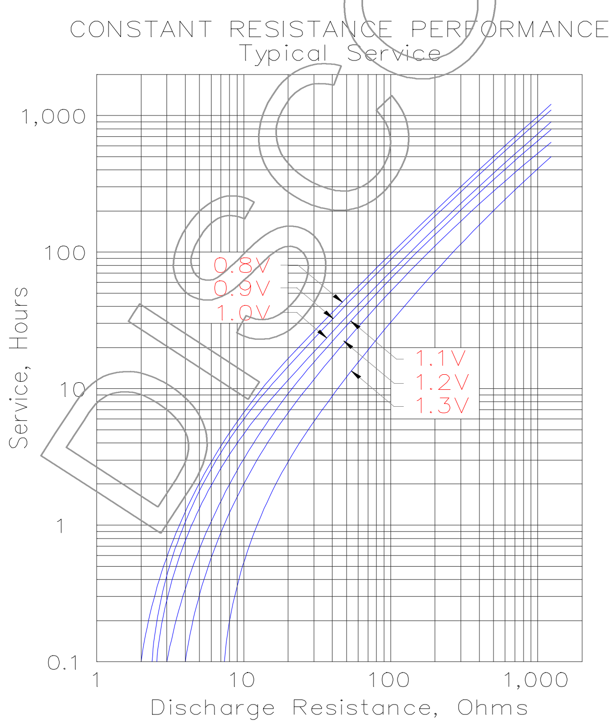
Dimensions (mm)

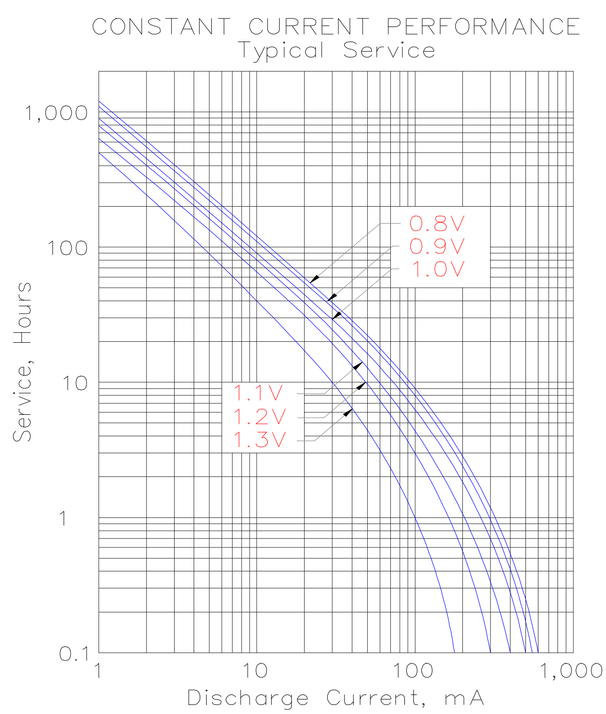


Chemical System:Zinc-Manganese Dioxide (Zn/MnO_2)

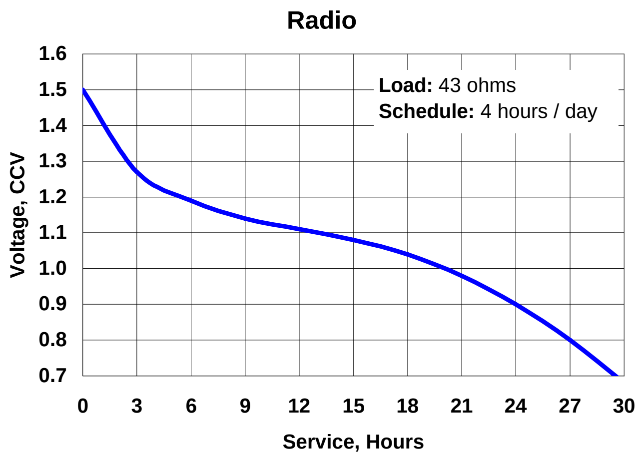
Designation: ANSI-15F, IEC-R6
Battery Voltage: 1.5 Volts
Average Weight: 15 grams (0.5 oz.)
Volume: 8.0 cubic centimeters (0.5 cubic inch)
Average Service capacity (to 0.8 Volts): 700 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 15 (size "AA")
Jacket: Plastic Laminated Paper

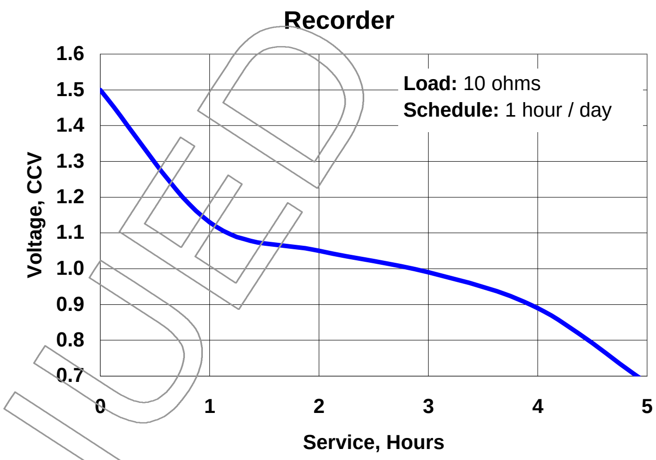
Millimeters	Inches
0.10	0.004
0.80	0.031
1.10	0.043
2.10	0.083
2.80	0.110
13.50	0.531
14.30	0.563
47.50	1.870
48.80	1.921
49.20	1.937
50.10	1.972

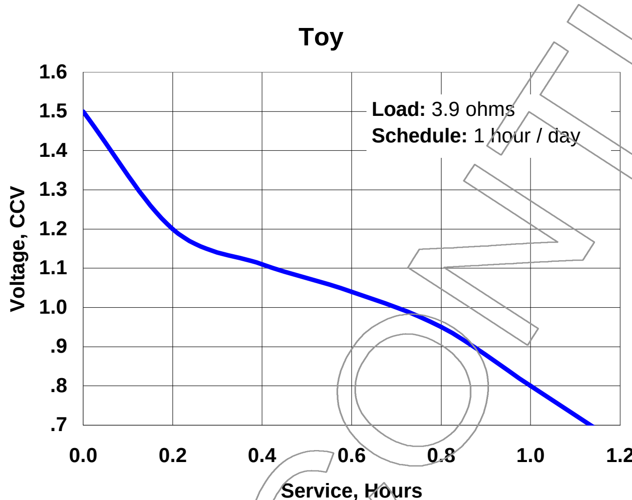


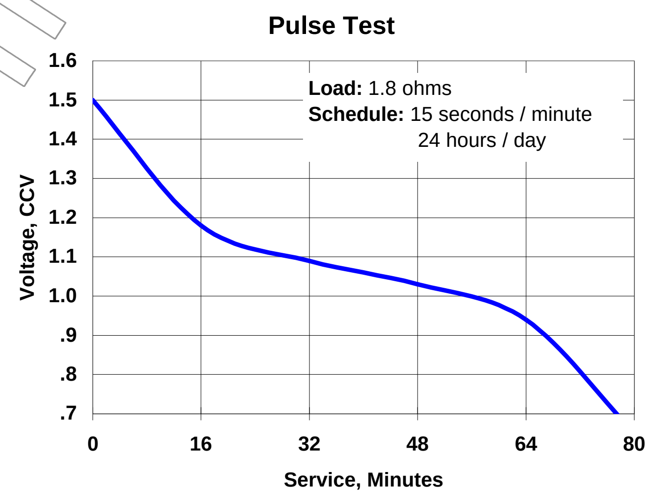


Typical Applications









INTERNAL RESISTANCE VS. TEMPERATURE
This measurement is an approximation of the battery's actual internal resistance. It is sensitive to the loads and operator technique.

Schedule: Background Load 750 ohms.
Pulse Load 4.0 ohms.
Pulse Duration 1 second

Temperature	Typical Ri (ohms)
45ºC (113ºF)	0.4
21ºC (70ºF)	0.5
0ºC (32ºF)	0.8
-21ºC (-4ºF)	5.0

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

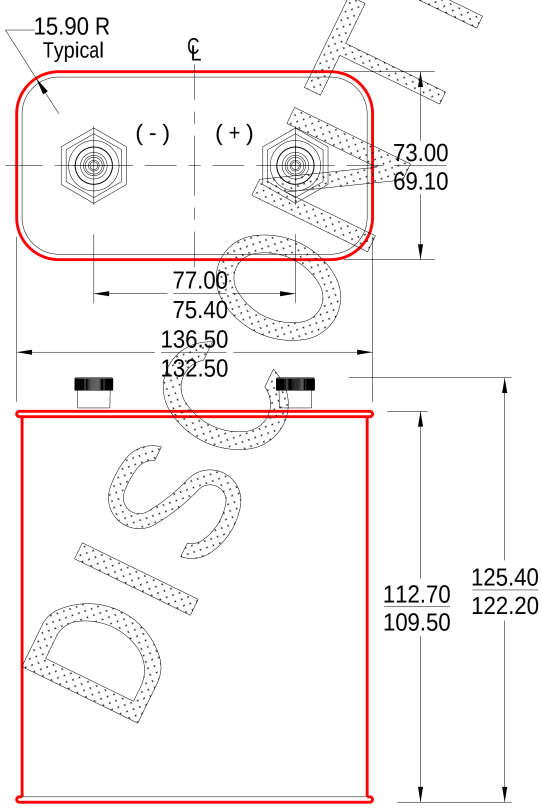
EVEREADY NO. 1231

Zinc Chloride ***6V***
Super Heavy Duty
No Added Mercury or Cadmium

Chemical System: Zinc-Manganese Dioxide ($Zn/Mn0_2$)

Designation: ANSI / NEDA-918D, IEC-4R25-2
Battery Voltage: 6 Volts
Average Weight: 1.27 kilograms (44.7 oz.)
Volume: 1123 cubic centimeters (68.5 cubic inch)
Cells: Eight No. 60 (size "F")-Two parallel strings of four in series.
Jacket: Metal

Dimensions (mm)



Millimeters	Inches
15.90	.626
69.10	2.720
73.00	2.874
75.40	2.969
77.00	3.031
109.50	4.311
112.70	4.437
122.20	4.811
125.40	4.937
132.50	5.217
136.50	5.374

Energizer

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

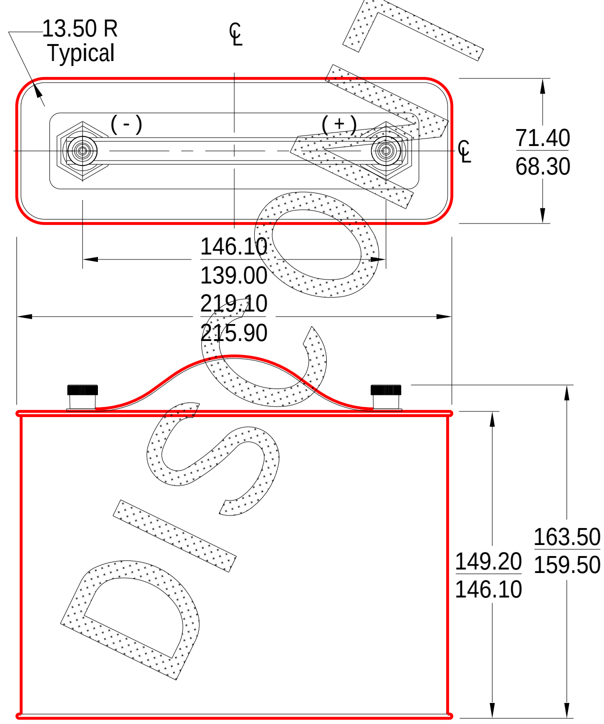
EVEREADY NO. 1461

Zinc Chloride ***6V***
No Added Mercury or Cadmium

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-907, IEC-4R25-4
Battery Voltage: 6 Volts
Average Weight: 2.68 kilograms (94.5 oz.)
Volume: 2334 cubic centimeters (142.4 cubic inch)
Cells: Sixteen No. 60 (size "F")-Four parallel strings of four in series.
Jacket: Metal

Dimensions (mm)



Millimeters	Inches
13.50	.531
68.30	2.689
71.40	2.811
139.00	5.472
146.10	5.752
149.20	5.874
159.50	6.280
163.50	6.437
215.90	8.500
219.10	8.626

Energizer

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

EVEREADY NO. 1463

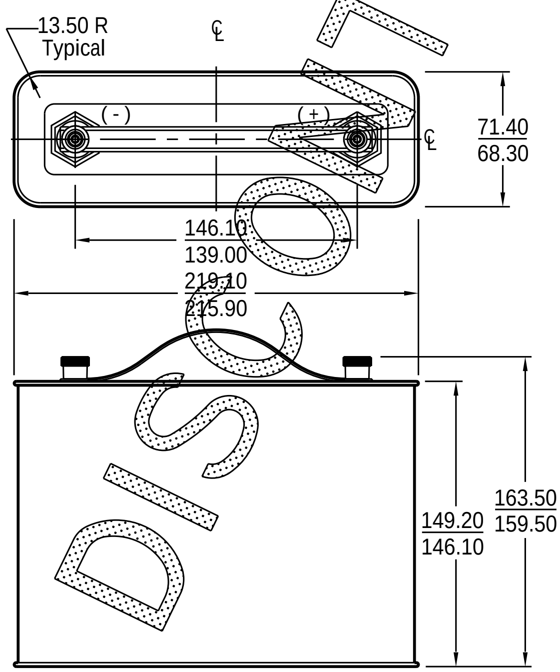
Zinc Chloride ***12V***
No Added Mercury or Cadmium

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-922, IEC-8R25-2
Battery Voltage: 12 Volts
Average Weight: 2.66 kilograms (93.8 oz.)
Volume: 2334 cubic centimeters (142.4 cubic inch)
Cells: Sixteen No. 60 (size "F")-Two parallel strings of eight in series.
Jacket: Metal

Dimensions (mm)

Millimeters	Inches
13.50	.531
68.30	2.689
71.40	2.811
139.00	5.472
146.10	5.752
149.20	5.874
159.50	6.280
163.50	6.437
215.90	8.500
219.10	8.626



Eveready Battery Company, Inc.

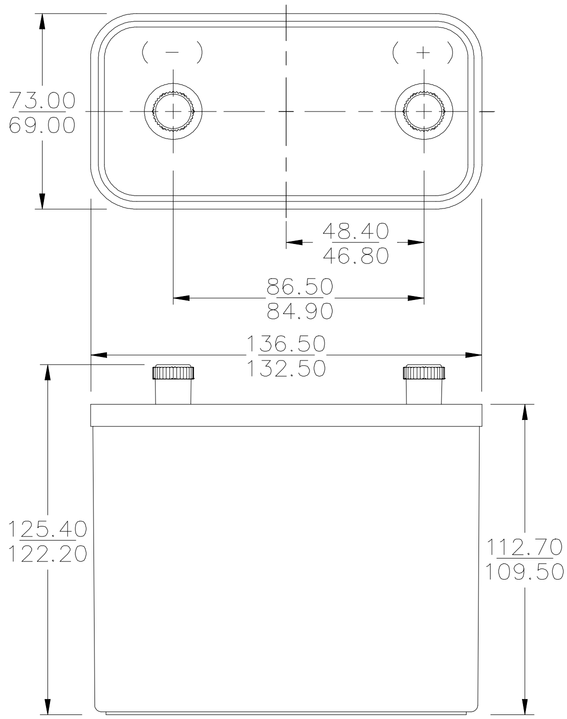
Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Zinc Chloride ***12V***
Classic
No Added Mercury or Cadmium

EVEREADY NO. 732

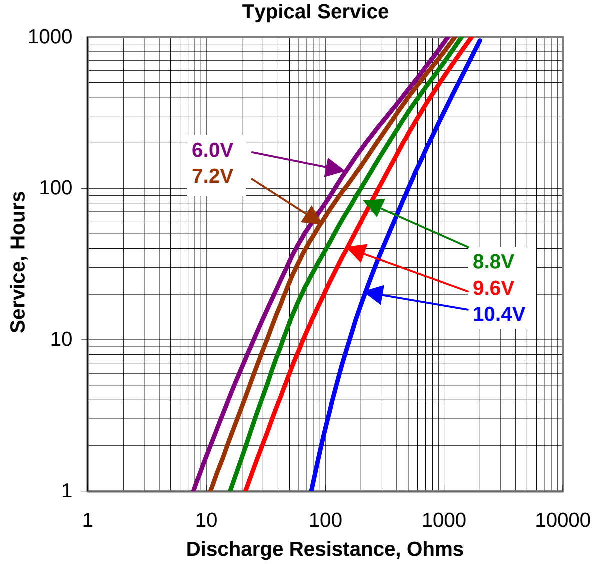
Dimensions (mm)



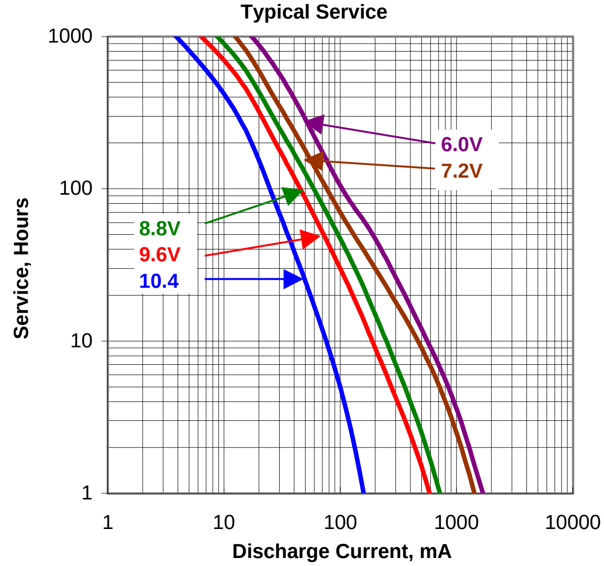
Chemical System:Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI-926, IEC-8R25
Battery Voltage: 12 Volts
Average Weight: 1.2 kilograms (42.5 oz.)
Volume: 1182 cubic centimeters (72 cubic inch)
Average Service capacity (to 6.0 Volts / cell): 7.5 Ah
(Rated capacity at 25 mA continuous drain)
Cell: Eight No. 60 (size "F") in series
Terminals: Insulated Knurl / Screw Post
Jacket: Plastic

Millimeters	Inches
46.80	1.843
48.40	1.906
69.00	2.717
73.00	2.874
84.90	3.343
86.50	3.406
109.50	4.311
112.70	4.437
122.20	4.811
125.40	4.937
132.50	5.217
136.50	5.374

CONSTANT RESISTANCE PERFORMANCE
Typical Service

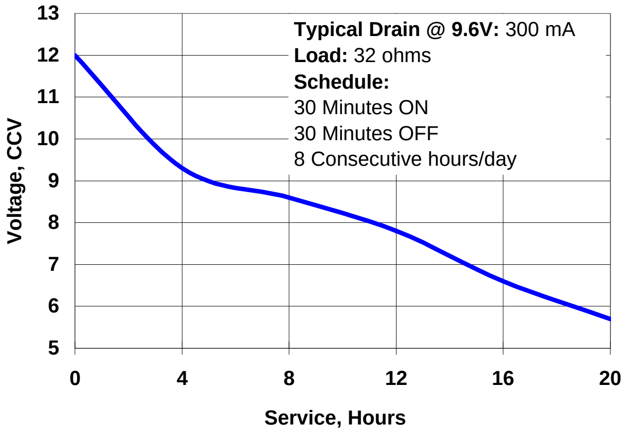


CONSTANT CURRENT PERFORMANCE
Typical Service

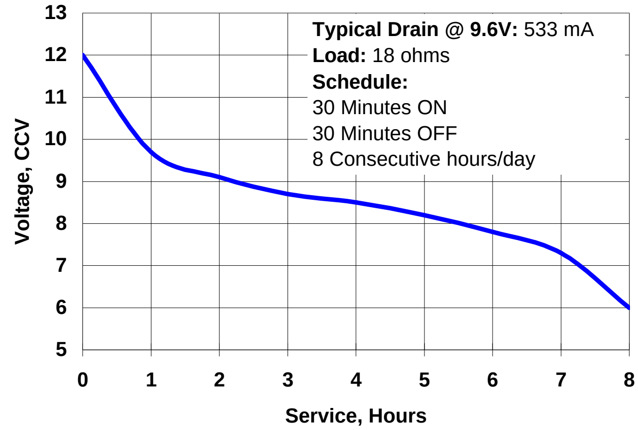


Typical Applications

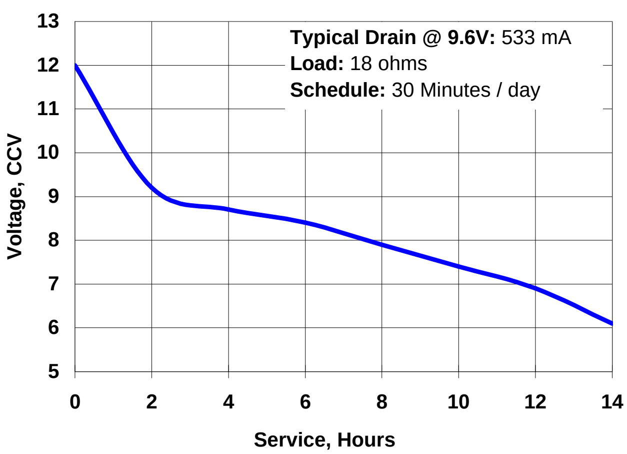
Intermittent Lighting Test



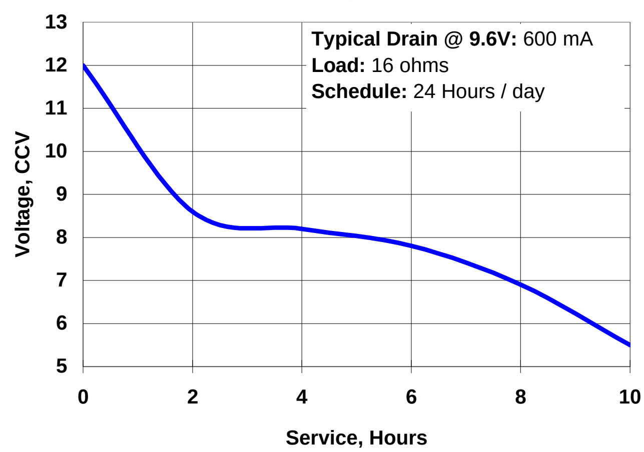
ANSI Lighting Test



Portable Lighting Test



Continuous Lighting Test



INTERNAL RESISTANCE VS. TEMPERATURE
This measurement is an approximation of the battery's actual internal resistance. It is sensitive to the loads and operator technique.

Schedule: Background Load 600 ohms.
Pulse Load 10 ohms.
Pulse Duration 1 second

Temperature	Typical Ri (ohms)
45ºC (113ºF)	2
21ºC (70ºF)	2.1
0ºC (32ºF)	2.4
-21ºC (-4ºF)	24

Important Notice

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

EVEREADY NO. 1862

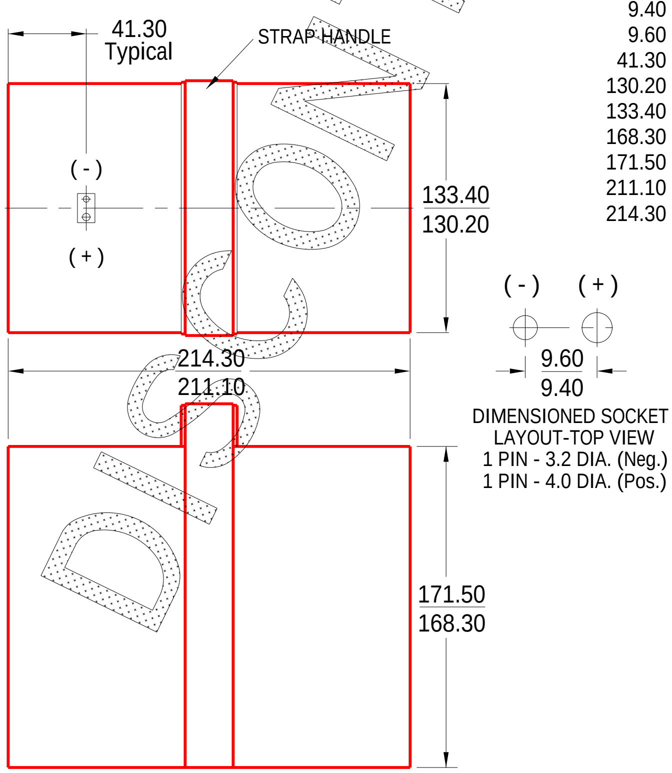
*Zinc Chloride **12V***
No Added Mercury or Cadmium

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-935, IEC-8R25-5
Battery Voltage: 12 Volts
Average Weight: 6.3 kilograms (222.2 oz.)
Volume: 4903 cubic centimeters (299.1 cubic inch)
Cells: Forty No. 60 (size "F")-Five parallel strings of eight in series.
Jacket: Metal

Dimensions (mm)

	Millimeters	Inches	
3.20	13.50	.531	.126
4.00	68.30	2.689	.157
9.40	71.40	2.811	.370
9.60	139.00	5.472	.378
41.30	146.10	5.752	1.626
130.20	149.20	5.874	5.126
133.40	159.50	6.280	5.252
168.30	163.50	6.437	6.626
171.50	215.90	8.500	6.752
211.10	219.10	8.626	8.311
214.30			8.437



Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

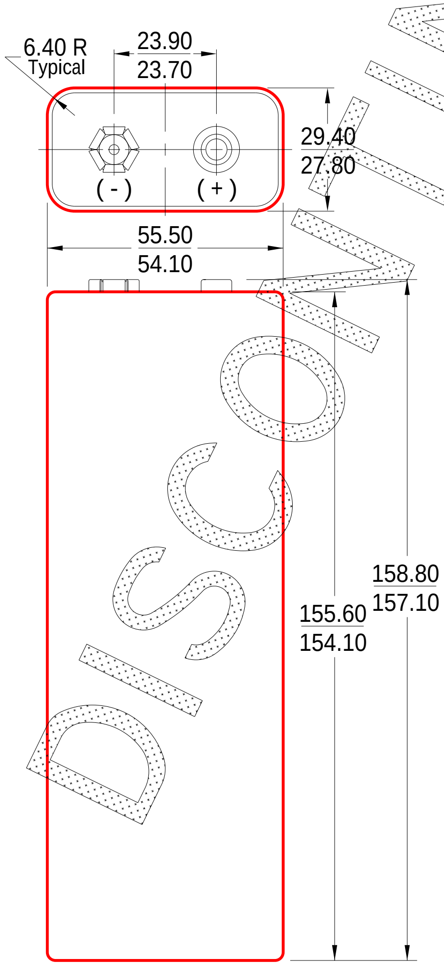
Engineering Data

EVEREADY NO. 2356N

LeClanche ***9V***
No Added Mercury or Cadmium

Chemical System: LeClanche-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-1612, IEC-6F22-9
Battery Voltage: 9 Volts
Average Weight: 357 grams (12.6 oz.)
Volume: 254 cubic centimeters (15.5 cubic inch)
Cells: Fifty four No. 117 and 118-Nine parallel strings of six in series.
Jacket: Metal



Dimensions (mm)

Millimeters	Inches
6.40	.252
23.70	.933
23.90	.941
27.80	1.094
29.40	1.157
54.10	2.130
55.50	2.185
154.10	6.067
155.60	6.126
157.10	6.185
158.80	6.252

Energizer

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

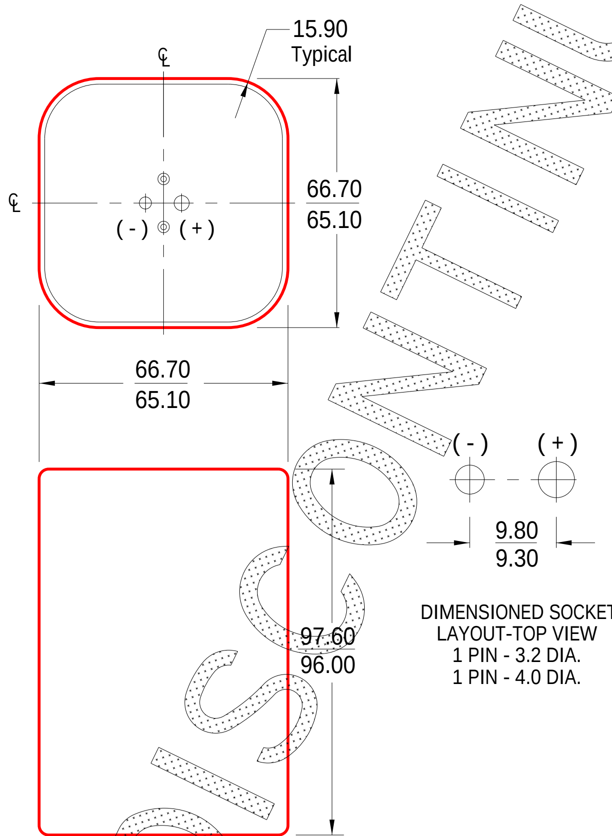
Engineering Data

EVEREADY NO. 2744N

Zinc Chloride ***6V***
No Added Mercury or Cadmium

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-920, IEC-4R25
Battery Voltage: 6 Volts
Average Weight: 632 grams (22.3 oz.)
Volume: 434 cubic centimeters (26.5 cubic inch)
Cells: Four No. 60 (size "F") in series.
Jacket: Metal



DIMENSIONED SOCKET
LAYOUT-TOP VIEW
1 PIN - 3.2 DIA.
1 PIN - 4.0 DIA.

Dimensions (mm)

Millimeters	Inches
3.20	.126
4.00	.157
9.30	.366
9.80	.386
15.90	.626
65.10	2.563
66.70	2.626
85.60	3.252
96.00	3.780
97.60	3.843
101.60	4.000

BATTERY SHALL PASS FREELY THROUGH A
CYLINDRICAL TUBE 82.6 DIAMETER X 101.6 LONG.

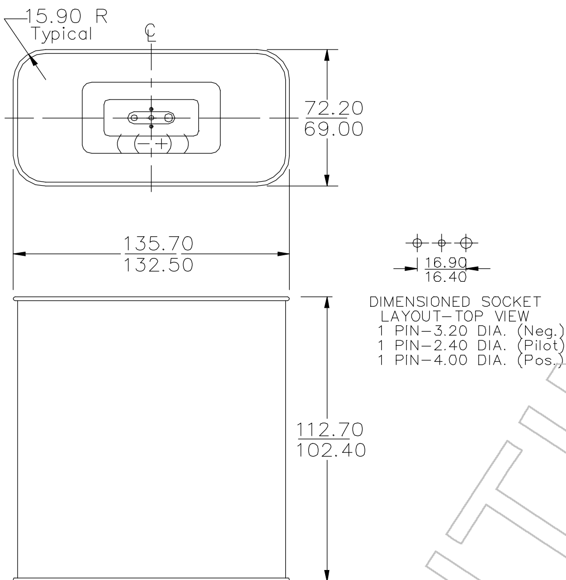
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. 2780N

Zinc Chloride 12V
No Added Mercury or Cadmium



Chemical System: Zinc Chloride-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-923, IEC-8R25
Typical Weight: 1.36 kilograms (47.9 oz.)
Volume: 1035 cubic centimeters (63.1 cubic in.)
Cells: Eight No. 60 (size "F") in series
Jacket: Metal
Terminal: Socket

Dimensions (mm)

Millimeters	Inches
2.40	0.094
3.20	0.126
4.00	0.157
15.90	0.626
16.40	0.646
16.90	0.665
69.00	2.717
72.20	2.843
102.4	4.031
112.7	4.437
132.5	5.217
135.7	5.343

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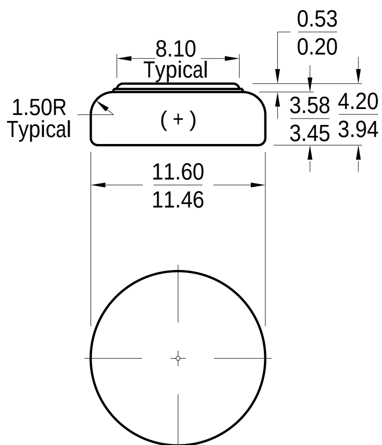
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. AC41E

Dimensions (mm)

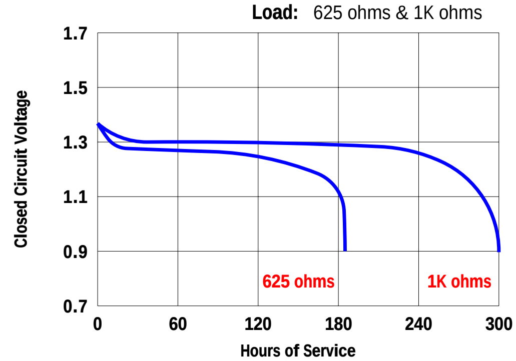


Millimeters	Inches
.20	.008
.53	.021
1.50	.059
3.45	.136
3.58	.141
3.94	.155
4.20	.165
8.10	.319
11.46	.451
11.60	.457

Chemical System: Zinc Air (ZnO_2)

Designation: ANSI / NEDA 7001Z, IEC-PR43
Battery Voltage: 1.4 Volts
Average Weight: 1.4 grams (0.05 oz.)
Volume: 0.5 cubic centimeters (0.03 cubic inch)
Average Service Capacity (to 0.9 Volt): 390 mAh
(Rated capacity at 1K ohms at 21°C)
Cell: AC41-P

TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 16 hours/day
Typical Drain @ 1.3V: 2.1 & 1.3 milliamperes
Load: 625 ohms & 1K ohms



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F) and 50% RH

Schedule	Typical Drains @ 1.3V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 0.9V hours
16 hours / day	1.3	1,000	300
16 hours / day	2.1	625	185

IMPEDANCE The typical impedance of these cells on open circuit and during useful discharge varies from 7-10 ohms. This applies over a frequency range of 40-5,000 hertz and at the current drains shown above.

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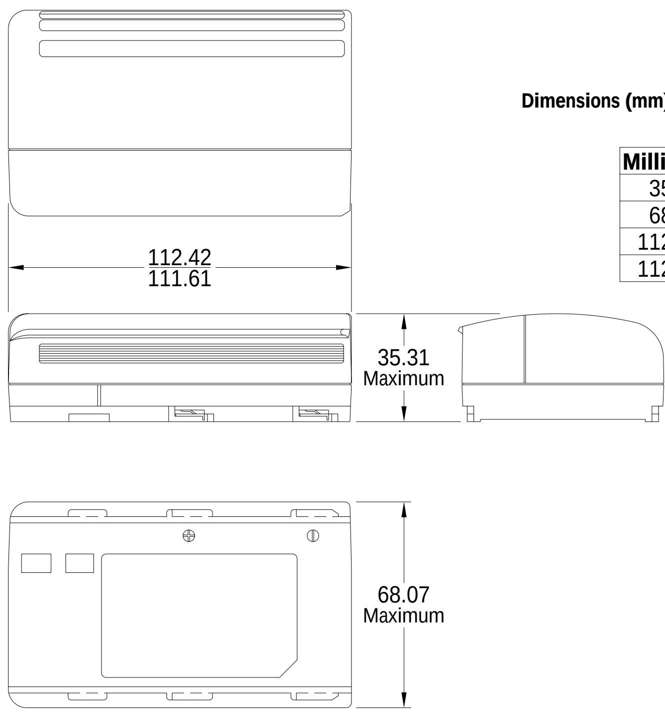
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CC1096

Designation: NiCd Camcorder Battery
For -

Nominal Voltage: 9.6 VDC
Typical Capacity: 1200 mAh
Typical Weight: 327 grams (11.6 oz.)



Dimensions (mm)

Millimeters	Inches
35.31	1.390
68.07	2.680
112.14	4.415
112.65	4.435

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Form No. EPS - 6301

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

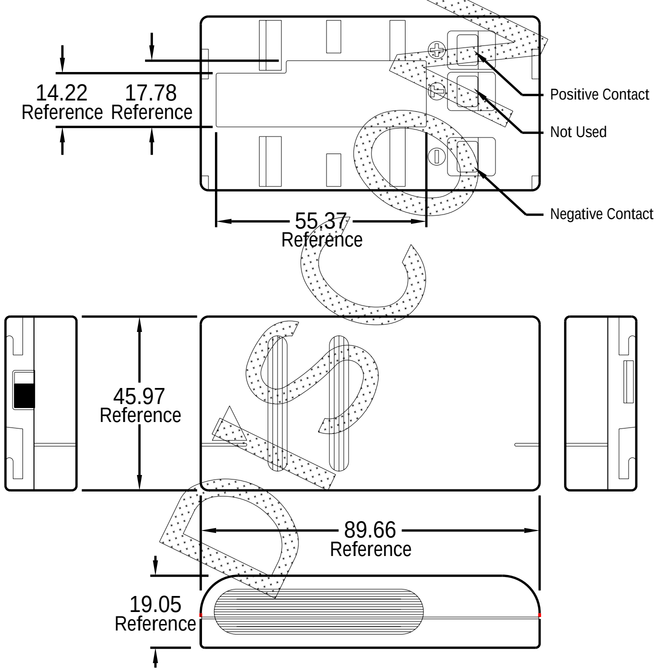
Engineering Data

ENERGIZER NO. CCM1460

Designation: NiCd Camcorder Battery
For Panasonic, JVC, RCA and GE

Nominal Voltage: 6 VDC
Typical Capacity: 1200 mAh
Typical Weight: 148.6 grams (5.3 oz.)

Dimensions (mm)



Millimeters	Inches
14.22	.560
17.78	.700
19.05	.750
45.97	1.810
55.37	2.180
89.66	3.530

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

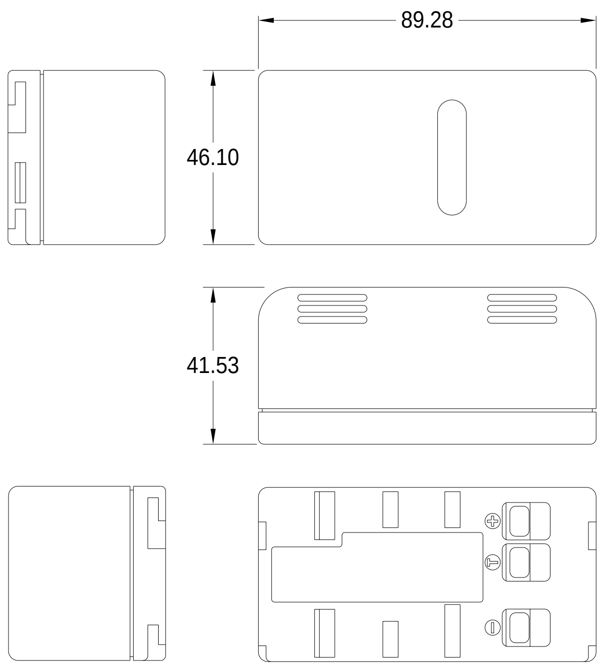
Engineering Data

ENERGIZER NO. CCM2460

Designation: NiCd VHS Camcorder Battery
For Panasonic, GE, JVC and RCA

Nominal Voltage: 6 VDC
Typical Capacity: 1800 mAh
Typical Weight: 303.1 grams (10.7 oz.)

Dimensions (mm)



Millimeters	Inches
41.53	1.635
46.10	1.815
89.28	3.515

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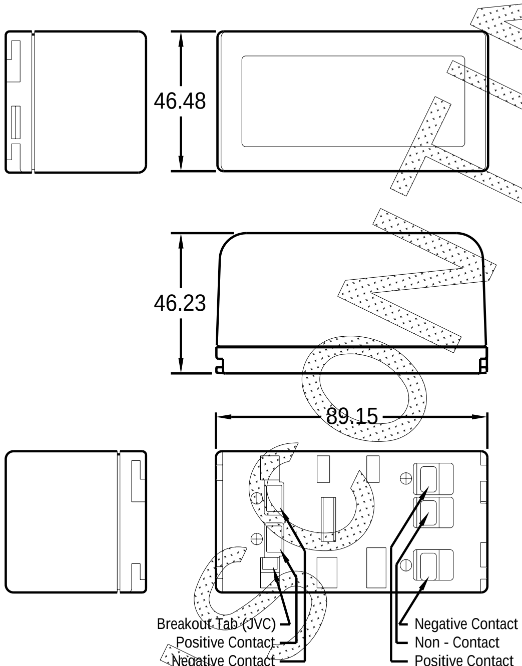
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CCM4060A

Designation: NiCd Camcorder Battery
For Sony, Panasonic, JVC, Sharp, RCA and GE

Nominal Voltage: 7.2 VDC
Typical Capacity: 1800 mAh
Typical Weight: 328 grams (11.6 oz.)



Dimensions (mm)

Millimeters	Inches
46.23	1.820
46.48	1.830
89.15	3.510

IMPORTANT NOTICE

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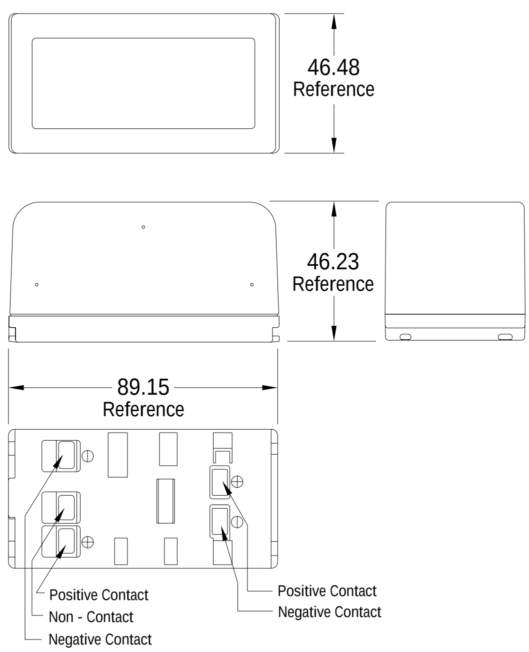
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CCM4060M

Designation: NiCd Camcorder Battery
For Sony, Panasonic, JVC, Sharp, RCA and GE

Nominal Voltage: 6.0 VDC
Typical Capacity: 2250 mAh
Typical Weight: 332 grams (11.8 oz.)



Dimensions (mm)

Millimeters	Inches
46.23	1.820
46.48	1.830
89.15	3.510

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

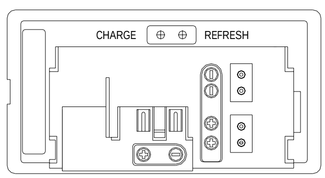
ENERGIZER MODEL NO. CDC100

Battery Charger

LISTED
97R7

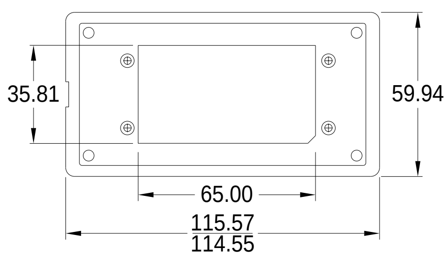
"POWER ADAPTER"
LR68809

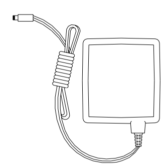
Designation: Universal Camcorder Battery Conditioner and Charging System
Charge Output: 270 mA @ 7.0 VDC
220 mA @ 7.25 VDC
Input Requirements: 8.7 VDC @ 300 mA
"Refresh" Discharge: 330 mA @ 6.5 VDC
Charge Capability: Assortment of 8mm and VHS-C Camcorder batteries
Charging Time: 6 hours (Reference)
Typical Weight: 73.7 grams (2.6 oz.)
Feature: Universal Camcorder Battery Charger
Dual LED's indicate charge / discharge mode

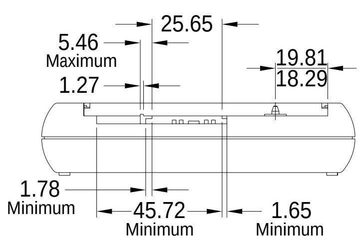


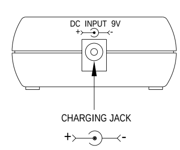
Dimensions (mm)

Millimeters	Inches
.76	.030
1.27	.050
1.65	.065
1.78	.070
5.46	.215
18.29	.720
19.81	.780
25.65	1.010
35.81	1.410
45.72	1.800
59.94	2.360
65.00	2.559
114.55	4.510
115.57	4.550









IMPORTANT NOTICE

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![Energizer]

Eveready Battery Company, Inc.

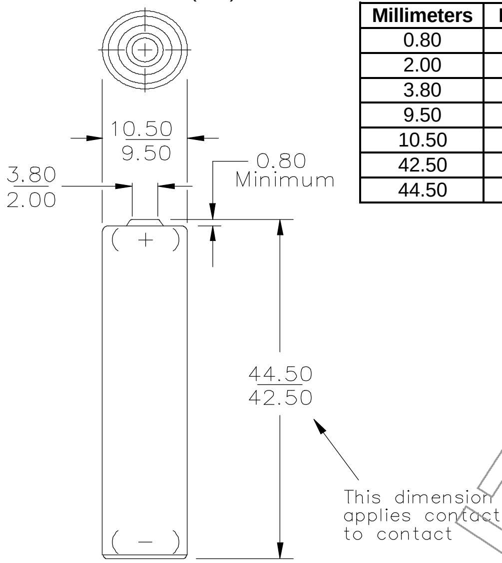
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

AAA
Rechargeable **1.2V**
Nickel-Cadmium

ENERGIZER NO. CH12

Dimensions (mm)



Millimeters	Inches
0.80	0.031
2.00	0.079
3.80	0.150
9.50	0.374
10.50	0.413
42.50	1.673
44.50	1.752

Chemical System: Nickel-Cadmium (NiCd)

Designation:ANSI / NEDA-10024, IEC-KR117/45
Battery Voltage: 1.2 Volts
Average Weight: 9.5 grams (0.3 oz.)
Volume: 3.8 cubic centimeters (0.23 cubic inch)
Terminals: Flat Contact
Rated Capacity: (to 1.0 Volt): 220 mAh
(Based on 44 mA (0.2C) discharge rate)
Maximum Charge Rate: 66 mA
Jacket: Plastic

Internal resistance

The internal resistance of the cell varies with state of charge, as follows:

Cell Charged	Cell 1/2 Discharged
60 milliohms	65 milliohms

(Tolerance of ±20% applies to above values)

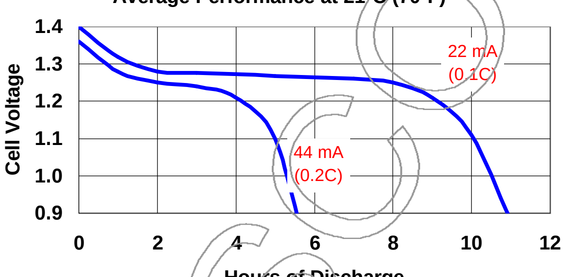
AC Impedance (No Load)

The impedance of the charged cell varies with frequency, as follows:

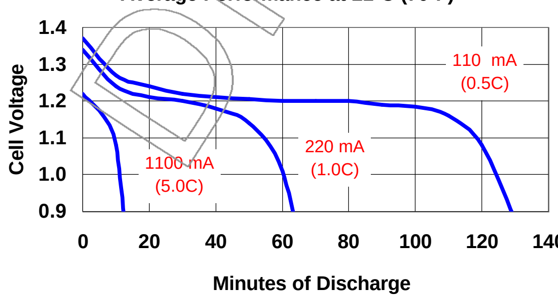
Frequency (Hz)	Impedance (milliohms) (Charged Cell)
50	23
1000	20
10000	18

Note: Above values based on AC current set at 1.0 ampere.
Value tolerances are ±20%

TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21°C (70°F)



TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21°C (70°F)



Operating and Storage Temperatures

Ranges of temperature applicable to operation of the CH12 cells are:

Charge @ 0.1C:	32ºF to 122ºF (0ºC to 50ºC)
Discharge @ 0.1C:	– 4ºF to 122ºF (-20ºC to 50ºC)
Storage:	– 40ºF to 140ºF (-40ºC to 60ºC) (6 Months Max.)
	– 4ºF to 95ºF (-20ºC to 35ºC) (2 Years Max.)

Operating at extreme temperature will significantly effect service and cycle life.

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Eveready Battery Company, Inc.

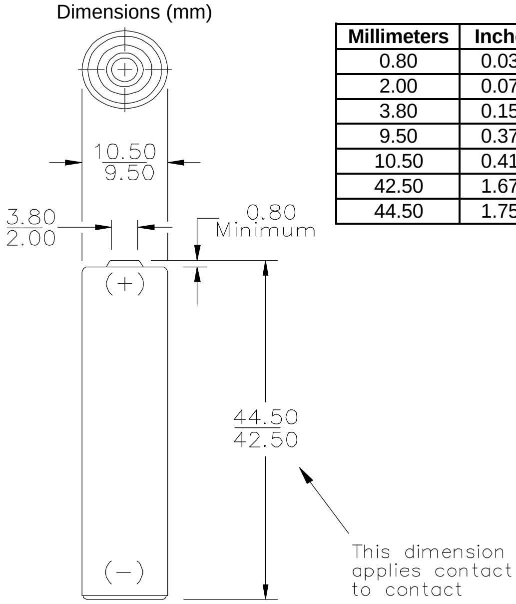
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

AAA
Rechargeable **1.2V**
Nickel-Metal Hydride (NiMH)

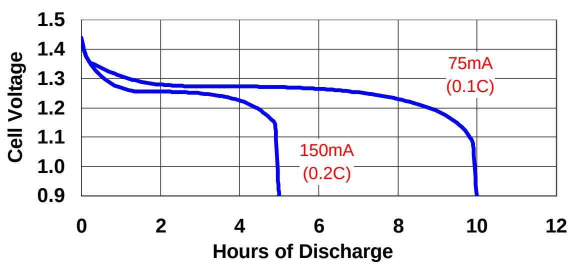
ENERGIZER NO. NH12

Dimensions (mm)

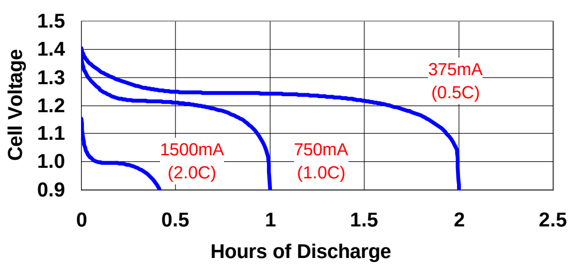


Millimeters	Inches
0.80	0.031
2.00	0.079
3.80	0.150
9.50	0.374
10.50	0.413
42.50	1.673
44.50	1.752

TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21ºC (70ºF)



TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21ºC (70ºF)



Chemical System: Nickel-Metal Hydride (NiMH)

Designation: Not Assigned
Battery Voltage: 1.2 Volts
Average Weight: 12 grams (0.4 oz.)
Volume: 3.8 cubic centimeters (0.2 cubic inch)
Terminals: Flat Contact
Rated Capacity: (to 1.0 Volt): 750 mAh
(Based on 150 mA (0.2C) discharge rate)
Maximum Charge Rate: 750 mA
Jacket: Plastic Sleeve

Internal resistance

The internal resistance of the cell varies with state of charge, as follows:

Cell Charged	Cell 1/2 Discharged
100 milliohms	120 milliohms

(Tolerance of ±20% applies to above values)

AC Impedance (No Load)

The impedance of the charged cell varies with frequency, as follows:

Frequency (Hz)	Impedance (milliohms) (Charged Cell)
1000	35

Note: Above values based on AC current set at 1.0 ampere.
Value tolerances are ±20%

Operating and Storage Temperatures

Ranges of temperature applicable to operation of the NH12 cells are:

Charge @ 0.1C: 32ºF to 122ºF (0ºC to 50ºC)
Discharge @ 0.1C: – 4ºF to 122ºF (-20ºC to 50ºC)
Storage: – 40ºF to 122ºF (-40ºC to 50ºC)
(6 months Max.)
– 4ºF to 95ºF (-20ºC to 35ºC)
(2 Years Max.)

Operating at extreme temperature will
significantly effect service and cycle life.

Important Notice

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Energizer

Eveready Battery Company, Inc.

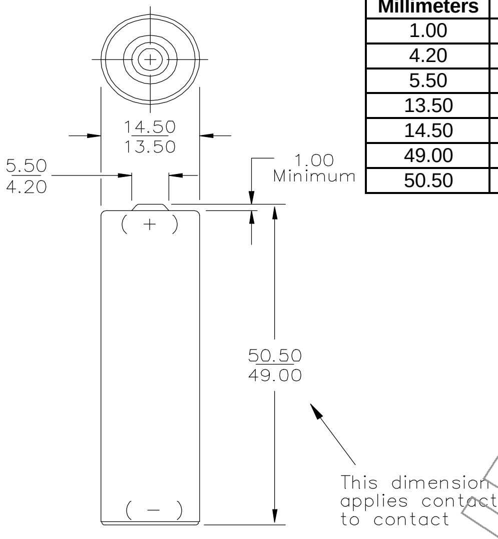
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

AA
Rechargeable **1.2V**
Nickel-Cadmium

ENERGIZER NO. CH15

Dimensions (mm)



Millimeters	Inches
1.00	0.039
4.20	0.165
5.50	0.217
13.50	0.531
14.50	0.571
49.00	1.929
50.50	1.988

Chemical System: Nickel-Cadmium (NiCd)

Designation:ANSI / NEDA-10015, IEC-KR157/51
Battery Voltage: 1.2 Volts
Average Weight: 22.7 grams (0.8 oz.)
Volume: 8.3 cubic centimeters (0.51 cubic inch)
Terminals: Flat Contact
Rated Capacity: (to 1.0 Volt): 650 mAh
(Based on 130 mA (0.2C) discharge rate)
Maximum Charge Rate: 195 mA
Jacket: Plastic

Internal resistance

The internal resistance of the cell varies with state of charge, as follows:

Cell Charged	Cell 1/2 Discharged
35 milliohms	45 milliohms

(Tolerance of ±20% applies to above values)

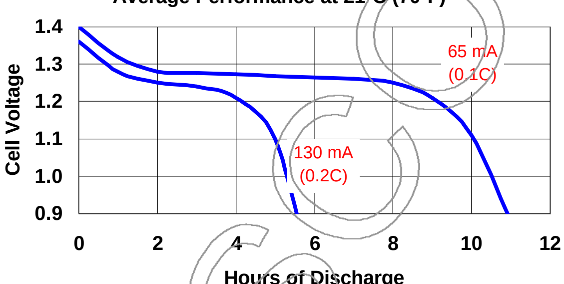
AC Impedance (No Load)

The impedance of the charged cell varies with frequency, as follows:

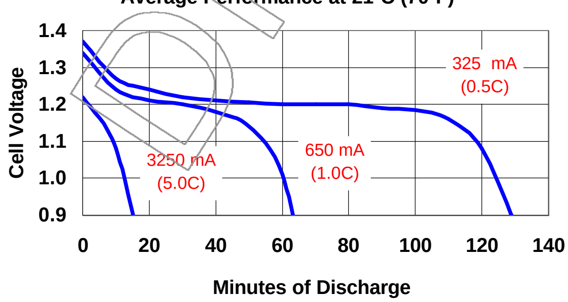
Frequency (Hz)	Impedance (milliohms) (Charged Cell)
50	19
1000	18
10000	20

Note: Above values based on AC current set at 1.0 ampere.
Value tolerances are ±20%

TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21°C (70°F)



TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21°C (70°F)



Operating and Storage Temperatures

Ranges of temperature applicable to operation of the CH15 cells are:

Charge @ 0.1C:	32ºF to 122ºF (0ºC to 50ºC)
Discharge @ 0.1C:	– 4ºF to 122ºF (-20ºC to 50ºC)
Storage:	– 40ºF to 140ºF (-40ºC to 60ºC) (6 Months Max.)
	– 4ºF to 95ºF (-20ºC to 35ºC) (2 Years Max.)

Operating at extreme temperature will significantly effect service and cycle life.

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Eveready Battery Company, Inc.

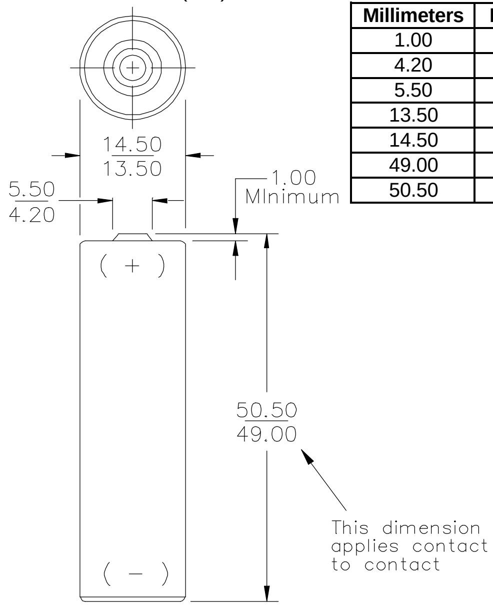
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

AA
Rechargeable **1.2V**
Nickel-Metal Hydride (NiMH)

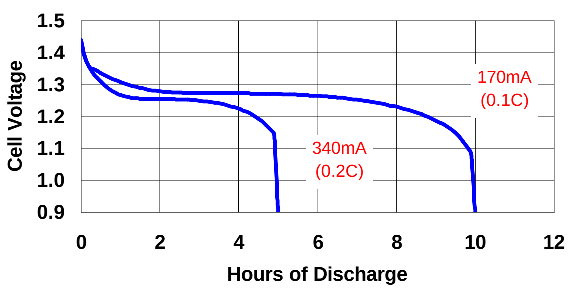
ENERGIZER NO. NH15

Dimensions (mm)

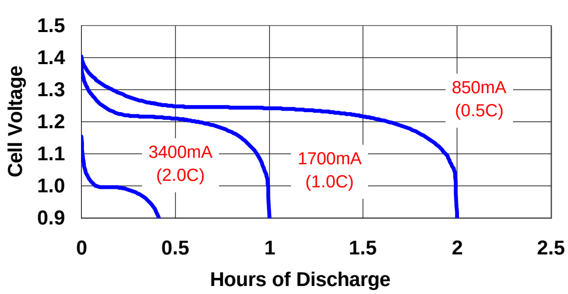


Millimeters	Inches
1.00	0.039
4.20	0.165
5.50	0.217
13.50	0.531
14.50	0.571
49.00	1.929
50.50	1.988

TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21ºC (70ºF)



TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21ºC (70ºF)



Chemical System: Nickel-Metal Hydride (NiMH)

Designation: Not Assigned
Battery Voltage: 1.2 Volts
Average Weight: 27 grams (1.0 oz.)
Volume: 8.3 cubic centimeters (0.5 cubic inch)
Terminals: Flat Contact
Rated Capacity: (to 1.0 Volt): 1.7 Ah
(Based on 340 mA (0.2C) discharge rate)
Maximum Charge Rate: 1700 mA
Jacket: Plastic Label

Internal resistance

The internal resistance of the cell varies with state of charge, as follows:

Cell Charged	Cell 1/2 Discharged
30 milliohms	40 milliohms

(Tolerance of ±20% applies to above values)

AC Impedance (No Load)

The impedance of the charged cell varies with frequency, as follows:

Frequency (Hz)	Impedance (milliohms) (Charged Cell)
1000	12

Note: Above values based on AC current set at 1.0 ampere.
Value tolerances are ±20%

Operating and Storage Temperatures

Ranges of temperature applicable to operation of the NH15 cells are:

Charge @ 0.1C: 32ºF to 122ºF (0ºC to 50ºC)
Discharge @ 0.1C: – 4ºF to 122ºF (-20ºC to 50ºC)
Storage: – 40ºF to 122ºF (-40ºC to 50ºC) (6 Months Max.)
– 4ºF to 95ºF (-20ºC to 35ºC) (2 Years Max.)

Operating at extreme temperature will
significantly effect service and cycle life.

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

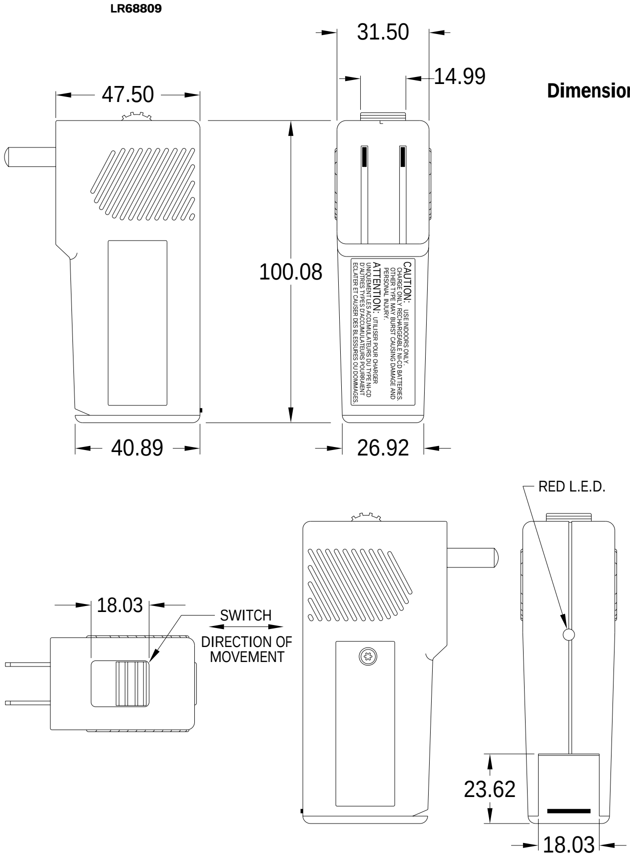
ENERGIZER MODEL NO. CH2AA

Battery Charger

LISTED
97R7

"POWER ADAPTER"
LR68809

Designation: Charge Man
Rapid Charger
Charge Output: 134 mA @ 104 VAC
175 mA @ 120 VAC
193 mA @ 127 VAC
Charge Capability: Two "AA"
Charging Time: 3 - 5 hours
Typical Weight: 368.3 grams (13 oz.)
Feature: Compact and lightweight



Dimensions (mm)

Millimeters	Inches
14.99	.590
18.03	.710
23.62	.930
26.92	1.060
31.50	1.240
40.89	1.610
47.50	1.870
100.08	3.940

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Eveready Battery Company, Inc.

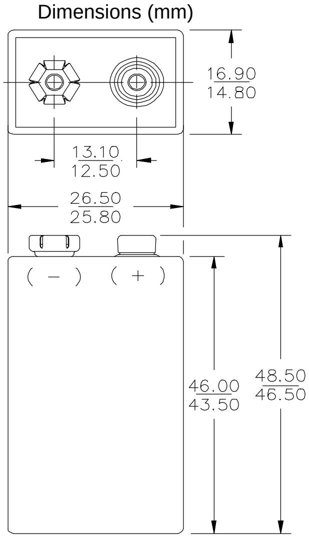
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Rechargeable **9V**
Nickel-Cadmium

ENERGIZER NO. CH22

Dimensions (mm)



Millimeters	Inches
12.50	0.492
13.10	0.516
14.80	0.583
16.90	0.665
25.80	1.016
26.50	1.043
43.50	1.713
46.00	1.811
46.50	1.831
48.50	1.909

Chemical System: Nickel-Cadmium (NiCd)

Designation:ANSI / NEDA-11604, IEC-6KR61
Battery Voltage: 7.2 Volts
Average Weight: 43 grams (1.5 oz.)
Volume: 21.7 cubic centimeters (1.3 cubic inch)
Rated Capacity: (to 1.0 Volt): 120 mAh
(Based on 24 mA (0.2C) discharge rate)
Maximum Charge Rate: 24mA
Jacket: Plastic Label

Internal resistance
The internal resistance of the cell varies with state of charge, as follows:

Cell Charged	Cell 1/2 Discharged
1000 milliohms	1500 milliohms

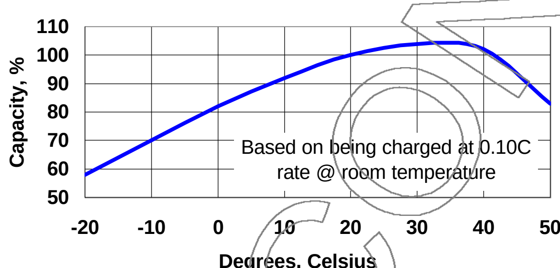
(Tolerance of ±20% applies to above values)

AC Impedance (No Load)
The impedance of the charged cell varies with frequency, as follows:

Frequency (Hz)	Impedance (milliohms) (Charged Cell)
50	1100
1000	950
10000	800

Note: Above values based on AC current set at 1.0 ampere.
Value tolerances are ±20%

CAPACITY VS. TEMPERATURE

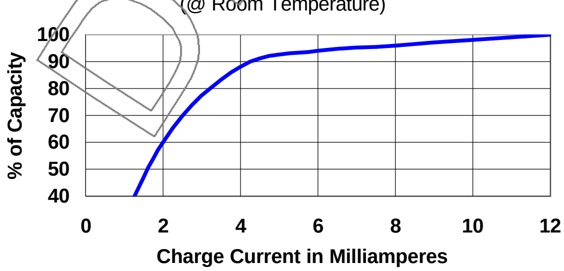


Ranges of temperature applicable to operation of the CH22 cells are:

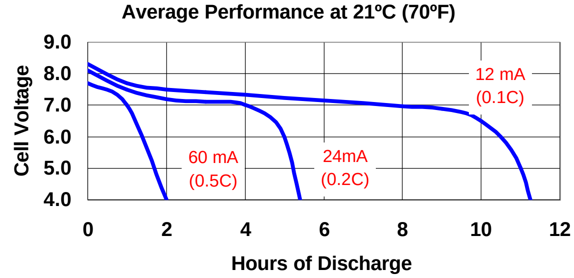
Charge @ 0.1C: 32ºF to 122ºF (0ºC to 50ºC)
Discharge @ 0.1C: – 4ºF to 122ºF (-20ºC to 50ºC)
Storage: – 40ºF to 140ºF (-40ºC to 60ºC) (6 Months Max.)
– 4ºF to 95ºF (-20ºC to 35ºC) (2 Years Max.)

Operating at extreme temperature will significantly effect service and cycle life.

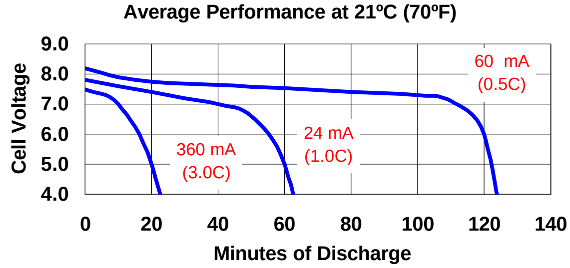
CHARGE ACCEPTANCE VS. CHARGE RATE
(@ Room Temperature)



TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21ºC (70ºF)



TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21ºC (70ºF)



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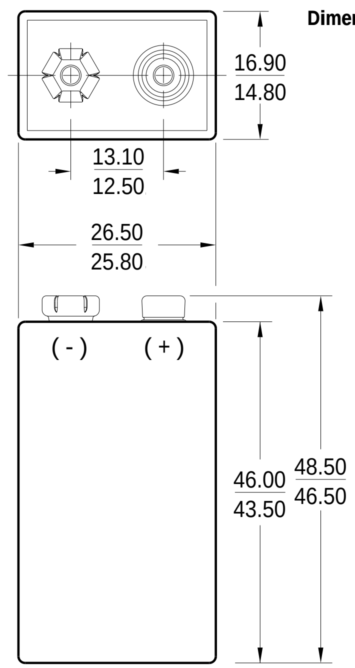
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. NH22

*Rechargeable **7.2V***
Nickel-Metal Hydride



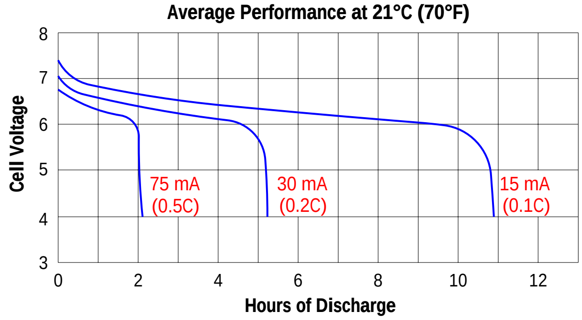
Dimensions (mm)

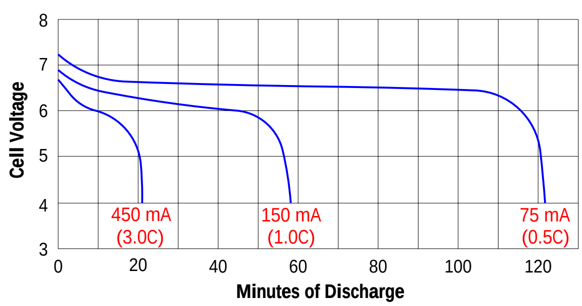
Millimeters	Inches
12.50	.492
13.10	.516
14.80	.583
16.90	.665
25.80	1.016
26.50	1.043
43.50	1.713
46.00	1.811
46.50	1.831
48.50	1.909

Chemical System: Nickel-Metal Hydride (NiMH)

Designation: Not Assigned
Battery Voltage: 7.2 Volts
Average Weight: 41 grams (1.5 oz.)
Volume: 21.7 cubic centimeters (1.3 cubic inch)
Terminals: Snap
Rated Capacity (to 6.0 Volt): 150 mAh
(Based on 30 mA (0.2C) discharge rate)
Maximum Charge Rate: 30 mA
Jacket: Plastic

TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21°C (70°F)





Internal Resistance

The internal resistance of the NH22 battery varies with state of charge, as follows:

Cell Charged	Cell 1/2 Discharged
1000 milliohms	1500 milliohms

(Tolerance of ±20% applies to above values)

AC Impedance (No Load)

The impedance of the charged cell varies with frequency, as follows:

Frequency (Hz)	Impedance (milliohms) (for charged cell)
1000	950

Note: Above values based on AC current set at 1.0 ampere.
Value tolerances are ±20%.

Operating and Storage Temperatures

Ranges of temperature applicable to operation of the NH22 cells are:

Charge @ 0.1C: 32°F to 122°F (0°C to 50°C)
Discharge @ 0.1C: -4°F to 122°F (-20°C to 50°C)
Storage: -40°F to 122°F (-40°C to 50°C) (6 Months Max.)
-4°F to 95°F (-20°C to 35°C) (2 Years Max.)

Operating at extreme temperature will significantly effect service and cycle life.

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Eveready Battery Company, Inc.

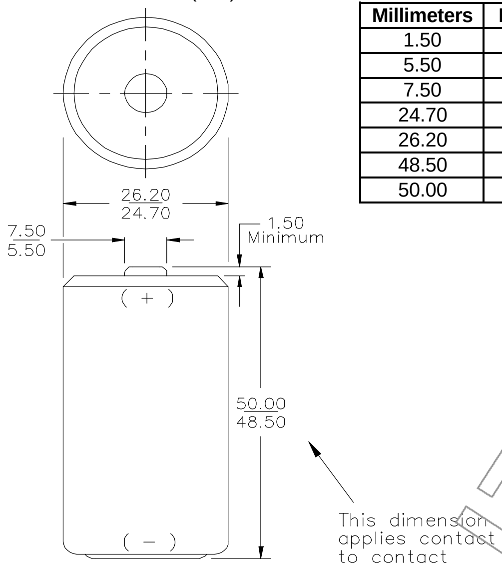
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

D
Rechargeable **1.2V**
Nickel-Cadmium

ENERGIZER NO. CH35

Dimensions (mm)



Millimeters	Inches
1.50	0.059
5.50	0.217
7.50	0.295
24.70	0.972
26.20	1.031
48.50	1.909
50.00	1.969

Chemical System: Nickel-Cadmium (NiCd)

Designation:ANSI / NEDA-10014, IEC-KR27/50
Battery Voltage: 1.2 Volts
Average Weight: 54 grams (1.9 oz.)
Volume: 26.9 cubic centimeters (1.6 cubic inch)
Terminals: Flat Contact
Rated Capacity: (to 1.0 Volt): 1.8 Ah
(Based on 360 mA (0.2C) discharge rate)
Maximum Charge Rate: 540 mA
Jacket: Plastic

Internal resistance

The internal resistance of the cell varies with state of charge, as follows:

Cell Charged	Cell 1/2 Discharged
20 milliohms	30 milliohms

(Tolerance of ±20% applies to above values)

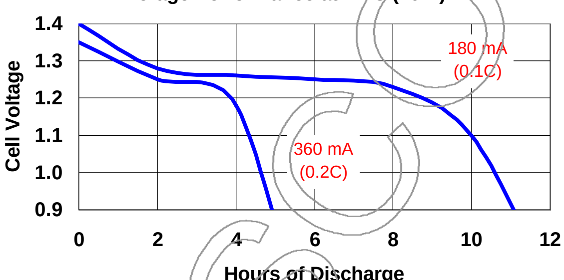
AC Impedance (No Load)

The impedance of the charged cell varies with frequency, as follows:

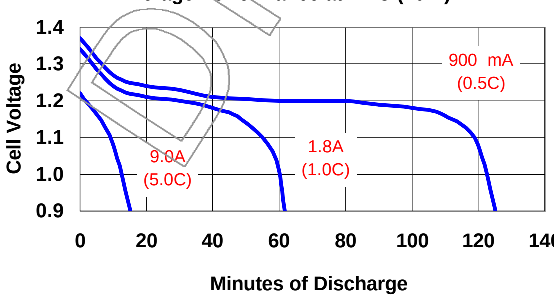
Frequency (Hz)	Impedance (milliohms) (Charged Cell)
50	12
1000	11
10000	14

Note: Above values based on AC current set at 1.0 ampere.
Value tolerances are ±20%

TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21°C (70°F)



TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21°C (70°F)



Operating and Storage Temperatures

Ranges of temperature applicable to operation of the CH35 cells are:

Charge @ 0.1C:	32ºF to 122ºF (0ºC to 50ºC)
Discharge @ 0.1C:	– 4ºF to 122ºF (-20ºC to 50ºC)
Storage:	– 40ºF to 140ºF (-40ºC to 60ºC) (6 Months Max.)
	– 4ºF to 95ºF (-20ºC to 35ºC) (2 Years Max.)

Operating at extreme temperature will significantly effect service and cycle life.

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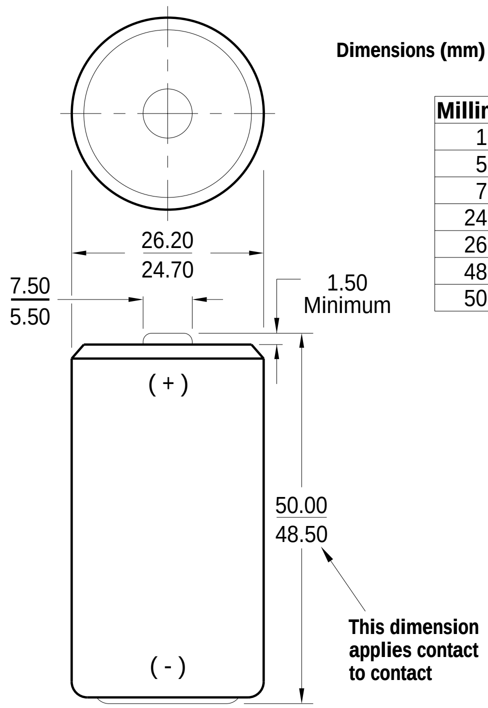
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. NH35

C
*Rechargeable **1.2V***
Nickel-Metal Hydride

Dimensions (mm)

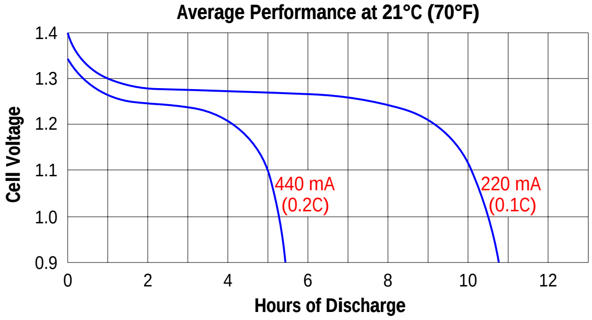


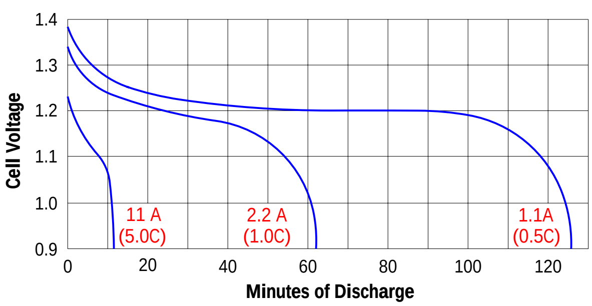
Millimeters	Inches
1.50	.059
5.50	.217
7.50	.295
24.70	.972
26.20	1.031
48.50	1.909
50.00	1.968

Chemical System: Nickel-Metal Hydride (NiMH)

Designation: Not Assigned
Battery Voltage: 1.2 Volts
Average Weight: 60 grams (2.1 oz.)
Volume: 26.9 cubic centimeters (1.6 cubic inch)
Terminals: Flat Contact
Rated Capacity (to 1.0 Volt): 2.2 Ah
(Based on 440 mA (0.2C) discharge rate)
Maximum Charge Rate: 440 mA
Jacket: Plastic

TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21°C (70°F)





Internal Resistance

The internal resistance of the cell varies with state of charge, as follows:

Cell Charged	Cell 1/2 Discharged
11 milliohms	21 milliohms

(Tolerance of ±20% applies to above values)

AC Impedance (No Load)

The impedance of the charged cell varies with frequency, as follows:

Frequency (Hz)	Impedance (milliohms) (for charged cell)
1000	9

Note: Above values based on AC current set at 1.0 ampere.
Value tolerances are ±20%.

Operating and Storage Temperatures

Ranges of temperature applicable to operation of the NH35 cells are:

Charge @ 0.1C: 32°F to 122°F (0°C to 50°C)
Discharge @ 0.1C: -4°F to 122°F (-20°C to 50°C)
Storage: -40°F to 122°F (-40°C to 50°C) (6 Months Max.)
-4°F to 95°F (-20°C to 35°C) (2 Years Max.)

Operating at extreme temperature will significantly effect service and cycle life.

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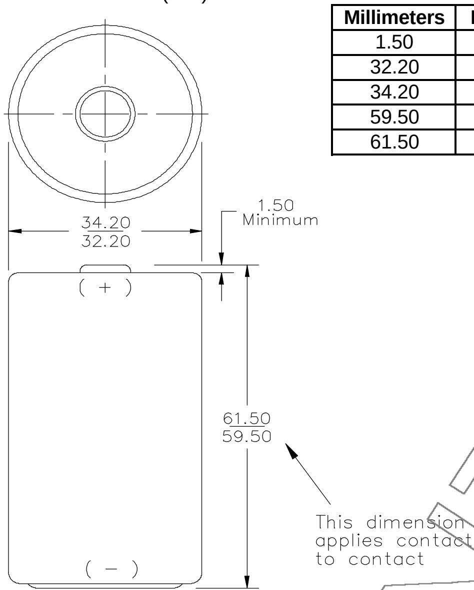
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

D
Rechargeable **1.2V**
Nickel-Cadmium

ENERGIZER NO. CH4

Dimensions (mm)

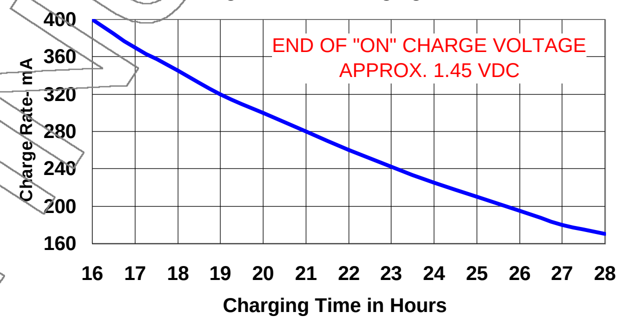


Millimeters	Inches
1.50	0.059
32.20	1.268
34.20	1.346
59.50	2.343
61.50	2.421

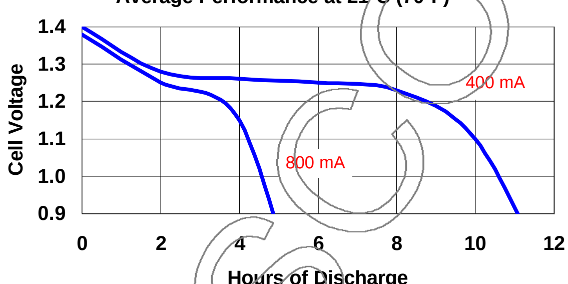
Chemical System: Nickel-Cadmium (NiCd)

Designation: ANSI / NEDA-10013HC, IEC-KR35/62
Battery Voltage: 1.2 Volts
Average Weight: 135 grams (4.7 oz.)
Volume: 51.0 cubic centimeters (3.1 cubic inch)
Terminals: Flat Contact
Rated Capacity: (to 1.0 Volt): 4 Ah
(Based on 800 mA (0.2C) discharge rate)
Cell: One "D" size
Jacket: Laminated Shrinkhose

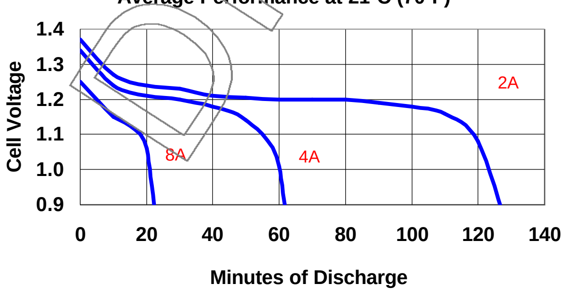
Charge Rate vs. Charging Time



TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21°C (70°F)



TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21°C (70°F)



Charge Rate

Standard-charge batteries at 400 mA for 16 to 18 hours to reach full capacity.

Quick, Without Charge Control - charge batteries at 800 mA for 7-8 hours to reach full capacity.

Quick, Without Charge Control (timer)- charge batteries at 1600 mA for 3 hours, then switch to a lower rate (0.2C to 0.1C) to reach full capacity.

Trickle-charge batteries at 200 mA continuously to maintain a full state of charge.

Quick, Without Comments - To maintain a fully charged cell for standby service, charge at trickle rate. Cycle life will generally increase as the charge rate is reduced. Charge rates significantly below 200 mA (0.05C) will not fully recharge a completely discharged cell.

Operating and Storage Temperatures

Ranges of temperature applicable to operation of the CH4 cells are:
Charge @ 0.1C: 32ºF to 122ºF (0ºC to 50ºC)
Discharge @ 0.1C: – 4ºF to 122ºF (-20ºC to 50ºC)
Storage: – 40ºF to 140ºF (-40ºC to 60ºC) (6 Months Max.)
– 4ºF to 95ºF (-20ºC to 35ºC) (2 Years Max.)
Operating at extreme temperature will significantly effect service and cycle life.

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![Energizer]

Eveready Battery Company, Inc.

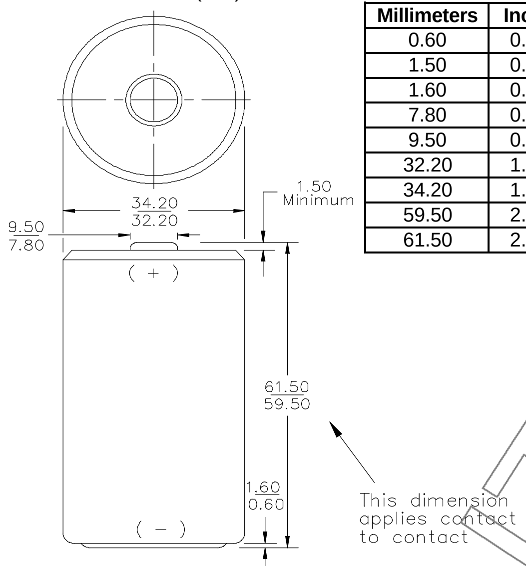
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

D
Rechargeable **1.2V**
Nickel-Cadmium

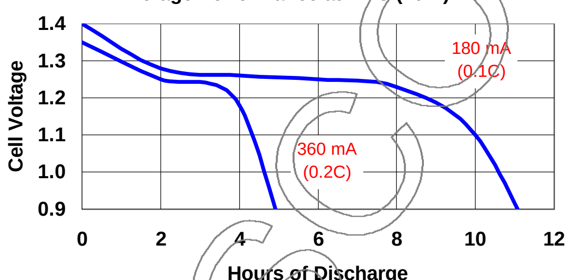
ENERGIZER NO. CH50

Dimensions (mm)

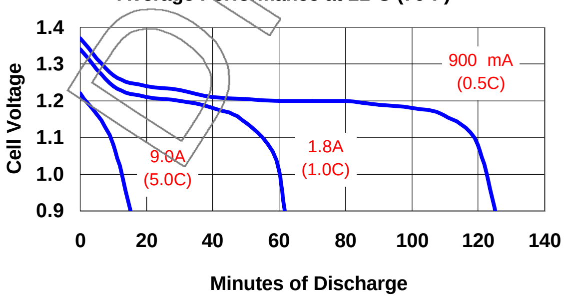


Millimeters	Inches
0.60	0.024
1.50	0.059
1.60	0.063
7.80	0.307
9.50	0.374
32.20	1.268
34.20	1.346
59.50	2.343
61.50	2.421

TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21°C (70°F)



TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21°C (70°F)



Chemical System: Nickel-Cadmium (NiCd)

Designation:ANSI / NEDA-10013, IEC-KR35/82
Battery Voltage: 1.2 Volts
Average Weight: 67 grams (2.4 oz.)
Volume: 56.5 cubic centimeters (3.5 cubic inch)
Terminals: Flat Contact
Rated Capacity: (to 1.0 Volt): 1.8 Ah
(Based on 360 mA (0.2C) discharge rate)
Maximum Charge Rate: 540 mA
Cell: One "sub C" in "D" size container
Jacket: Plastic Label

Internal resistance

The internal resistance of the cell varies with state of charge, as follows:

Cell Charged	Cell 1/2 Discharged
20 milliohms	30 milliohms

(Tolerance of ±20% applies to above values)

AC Impedance (No Load)

The impedance of the charged cell varies with frequency, as follows:

Frequency (Hz)	Impedance (milliohms) (Charged Cell)
50	12
1000	11
10000	14

Note: Above values based on AC current set at 1.0 ampere.
Value tolerances are ±20%

Operating and Storage Temperatures

Ranges of temperature applicable to operation of the CH50 cells are:

Charge @ 0.1C:	32ºF to 122ºF (0ºC to 50ºC)
Discharge @ 0.1C:	– 4ºF to 122ºF (-20ºC to 50ºC)
Storage:	– 40ºF to 140ºF (-40ºC to 60ºC) (6 Months Max.)
	– 4ºF to 95ºF (-20ºC to 35ºC) (2 Years Max.)

Operating at extreme temperature will
significantly effect service and cycle life.

Important Notice

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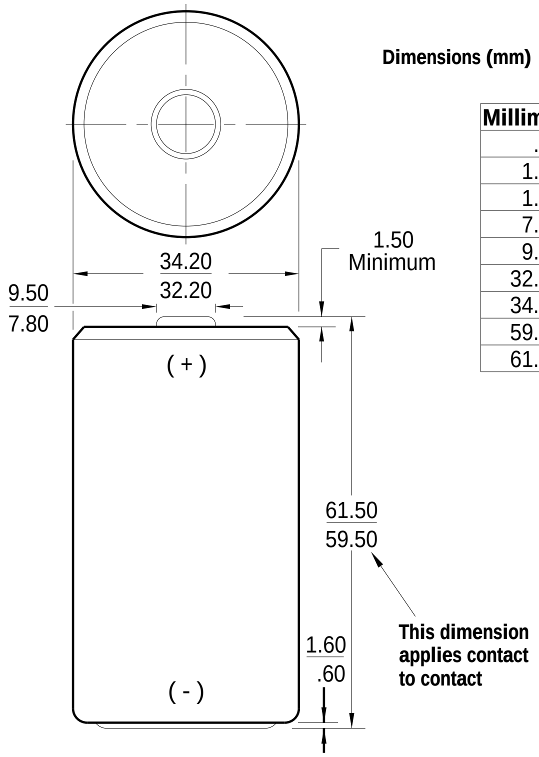
Form No. EBC - 6104A

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

D
Rechargeable ***1.2V***
Nickel-Metal Hydride

ENERGIZER NO. NH50



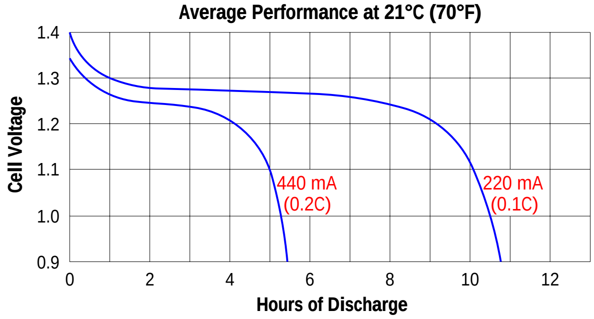
Dimensions (mm)

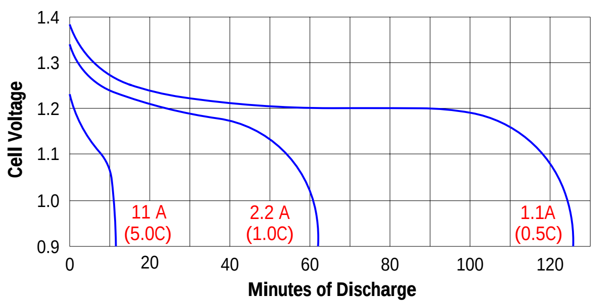
Millimeters	Inches
.60	.024
1.50	.059
1.60	.063
7.80	.307
9.50	.374
32.20	1.268
34.20	1.346
59.50	2.342
61.50	2.421

Chemical System: Nickel-Metal Hydride (NiMH)

Designation: Not Assigned
Battery Voltage: 1.2 Volts
Average Weight: 73 grams (2.6 oz.)
Volume: 56.5 cubic centimeters (3.5 cubic inch)
Terminals: Flat Contact
Rated Capacity (to 1.0 Volt): 2.2 Ah
(Based on 440 mA (0.2C) discharge rate)
Maximum Charge Rate: 440 mA
Jacket: Plastic

TYPICAL DISCHARGE CHARACTERISTICS
Average Performance at 21°C (70°F)





Internal Resistance

The internal resistance of the cell varies with state of charge, as follows:

Cell Charged	Cell 1/2 Discharged
11 milliohms	21 milliohms

(Tolerance of ±20% applies to above values)

AC Impedance (No Load)

The impedance of the charged cell varies with frequency, as follows:

Frequency (Hz)	Impedance (milliohms) (for charged cell)
1000	9

Note: Above values based on AC current set at 1.0 ampere.
Value tolerances are ±20%.

Operating and Storage Temperatures

Ranges of temperature applicable to operation of the NH50 cells are:

Charge @ 0.1C: 32°F to 122°F (0°C to 50°C)
Discharge @ 0.1C: -4°F to 122°F (-20°C to 50°C)
Storage: -40°F to 122°F (-40°C to 50°C) (6 Months Max.)
-4°F to 95°F (-20°C to 35°C) (2 Years Max.)

Operating at extreme temperature will significantly effect service and cycle life.

IMPORTANT NOTICE

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

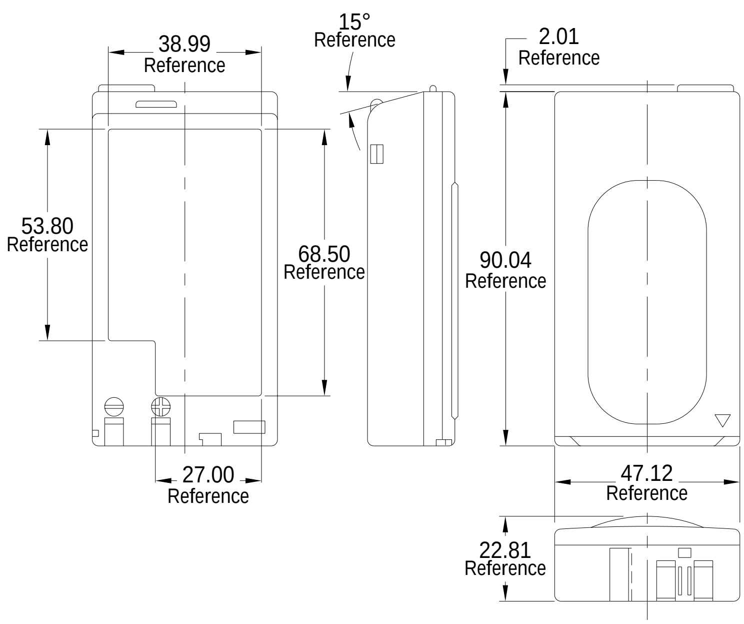
ENERGIZER NO. CM1060

Designation: NiCd Camcorder Battery
For Canon

Nominal Voltage: 6 VDC
Typical Capacity: 1200 mAh
Typical Weight: 157 grams (5.6 oz.)

Dimensions (mm)

Millimeters	Inches
2.01	.079
22.81	.898
27.00	1.063
38.99	1.535
47.12	1.855
53.80	2.118
68.50	2.697
90.04	3.545



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Eveready Battery Company, Inc.
Checkerboard Square
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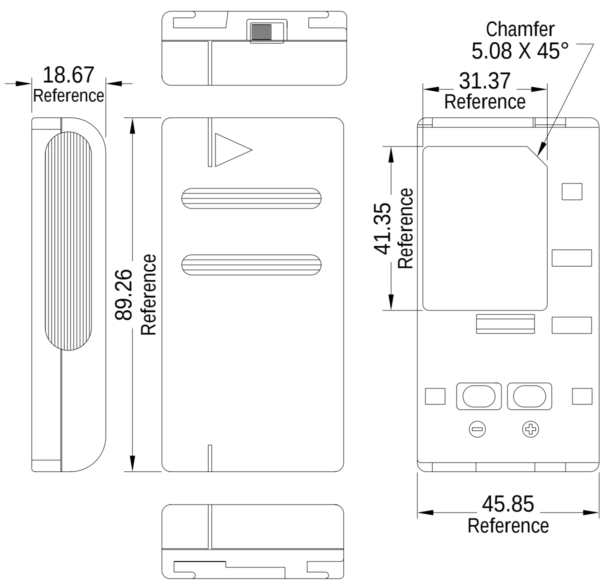
Engineering Data

ENERGIZER NO. CM1560

Designation: NiCd Camcorder Battery
For Sony and Sharp

Nominal Voltage: 6 VDC
Typical Capacity: 1200 mAh
Typical Weight: 170 grams (6.0 oz.)

Dimensions (mm)



Millimeters	Inches
5.08	.200
18.67	.735
31.37	1.235
41.35	1.628
45.85	1.805
89.26	3.514

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Engineering Data

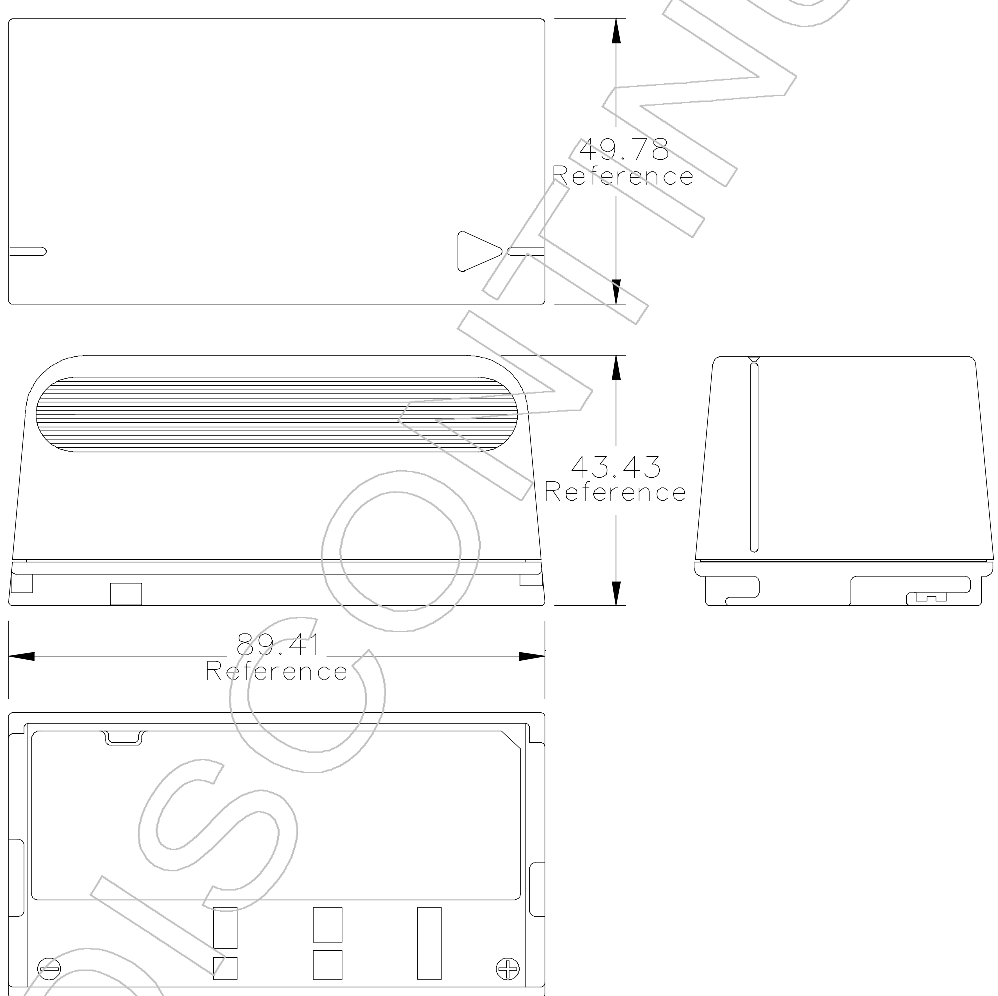
ENERGIZER NO. CM2360

Dimensions (mm)

Millimeters	Inches
43.43	1.710
49.78	1.960
89.41	3.520

Designation: NiCd Camcorder Battery
For RCA, Hitachi

Nominal Voltage: 6 VDC
Typical Capacity: 1800 mAh
Typical Weight: 303.1 grams (10.7 oz.)



Important Notice

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
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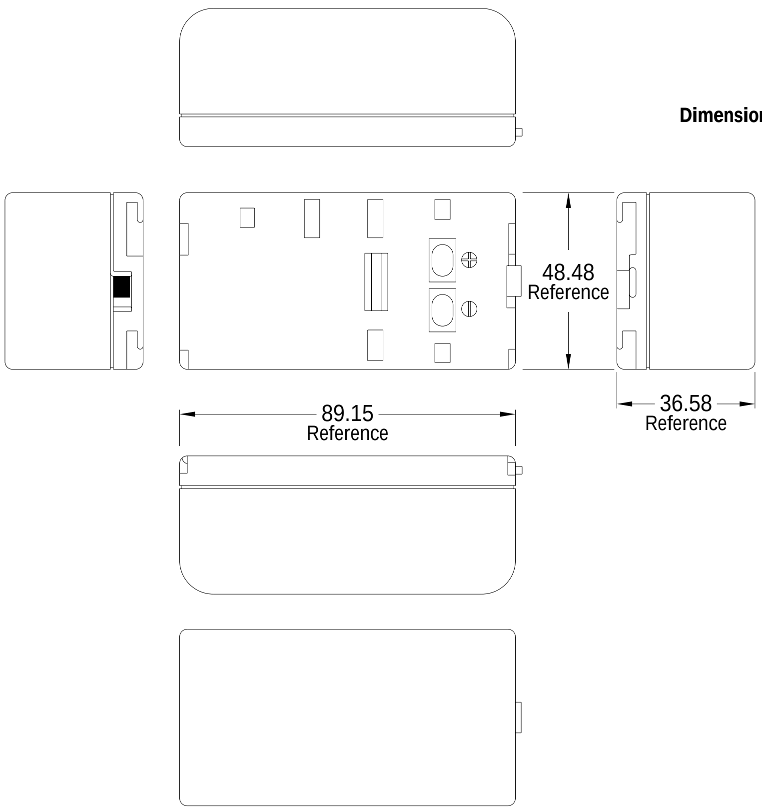
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CM4160

Designation: NiCd Camcorder Battery
For Sharp

Nominal Voltage: 6 VDC
Typical Capacity: 2400 mAh
Typical Weight: 300 grams (10.6 oz.)



Dimensions (mm)

Millimeters	Inches
36.58	1.440
46.48	1.830
89.15	3.510

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Eveready Battery Company, Inc.
Checkerboard Square
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Internet: www.energizer.com

Engineering Data

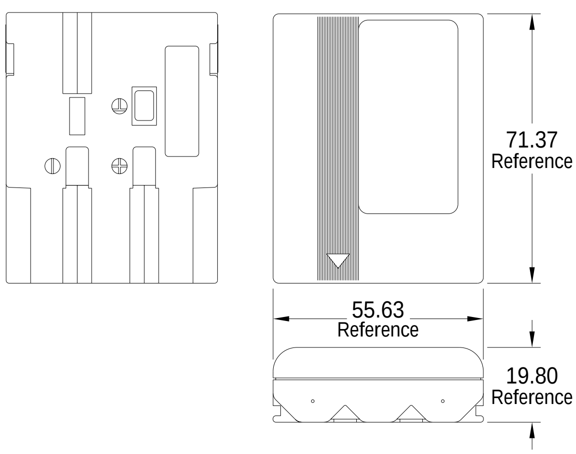
ENERGIZER NO. CM6036

Designation: NiMH Camcorder Battery
For Sharp

Nominal Voltage: 3.6 VDC
Typical Capacity: 2500 mAh
Typical Weight: 181.7 grams (6.4 oz.)

Dimensions (mm)

Millimeters	Inches
19.80	.780
55.63	2.190
71.37	2.810



IMPORTANT NOTICE

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Energizer

Eveready Battery Company, Inc.

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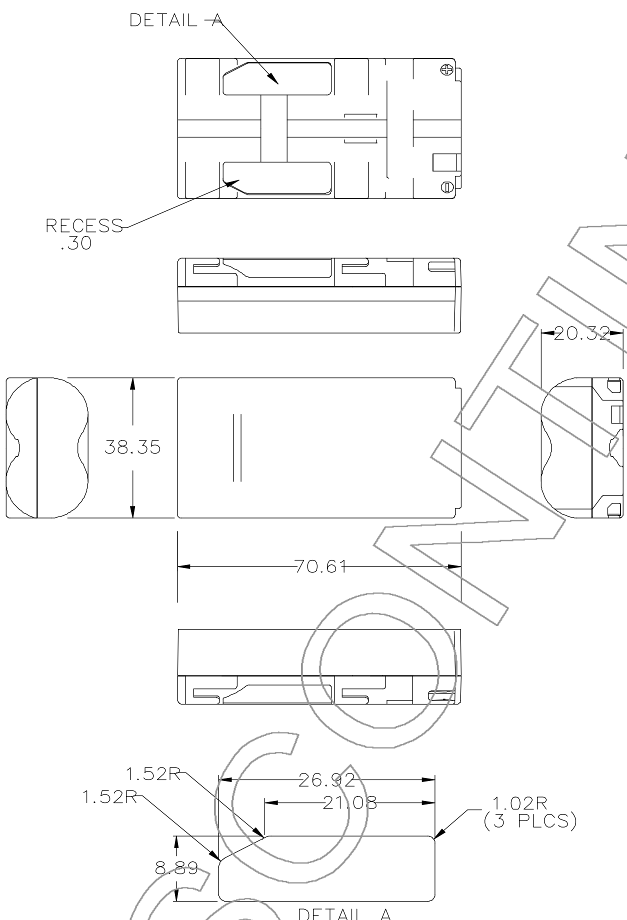
Engineering Data

ENERGIZER NO. CM9072

Dimensions (mm)



Chemical System: Lithium Ion Camcorder Battery (Sony)

Nominal Voltage: 7.2 VDC
Typical Weight: 97.8 grams (3.5 oz.)
Typical Capacity : 1500mAh

Millimeters	Inches
0.30	0.012
1.02	0.040
1.52	0.060
8.89	0.350
20.32	0.800
21.08	0.830
26.92	1.060
38.35	1.510
70.61	2.780

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Engineering Data

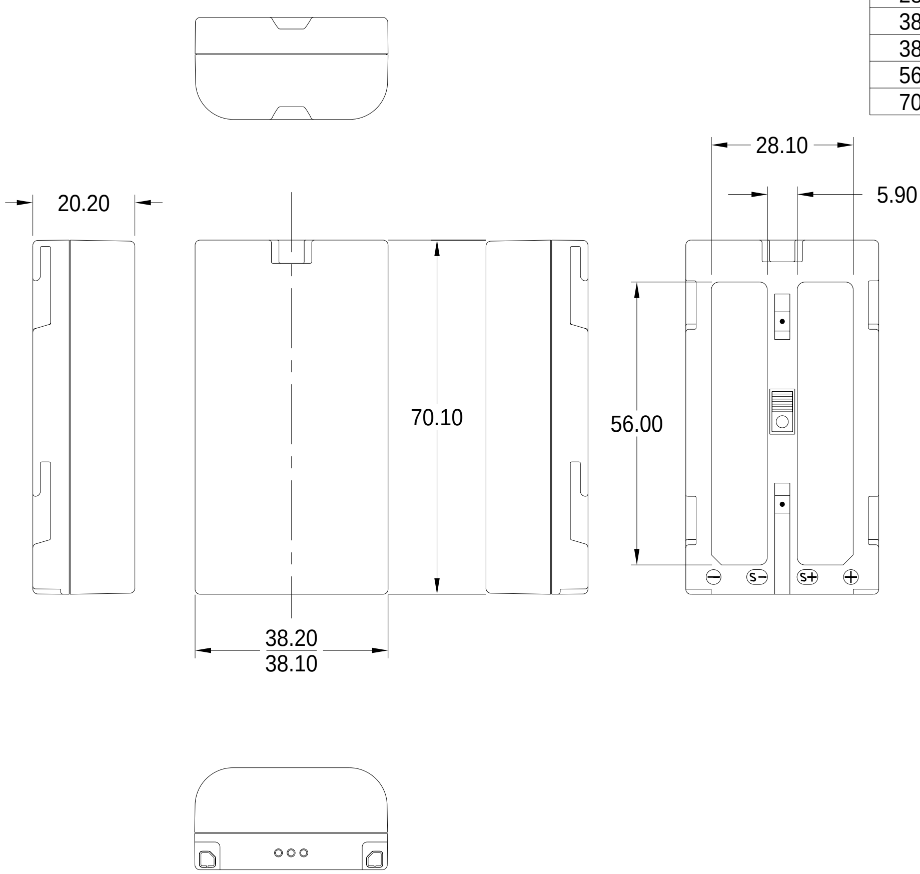
ENERGIZER NO. CM9172

Designation: Lithium Ion Camcorder Battery
For Hitachi, JVC, Panasonic, Proscan, RCA

Nominal Voltage: 7.2 VDC
Typical Capacity: 1500 mAh
Typical Weight: 98 grams (3.5 oz.)

Dimensions (mm)

Millimeters	Inches
5.90	.232
20.20	.795
28.10	1.106
38.10	1.500
38.20	1.504
56.00	2.205
70.10	2.760



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Checkerboard Square
St. Louis, MO 63164
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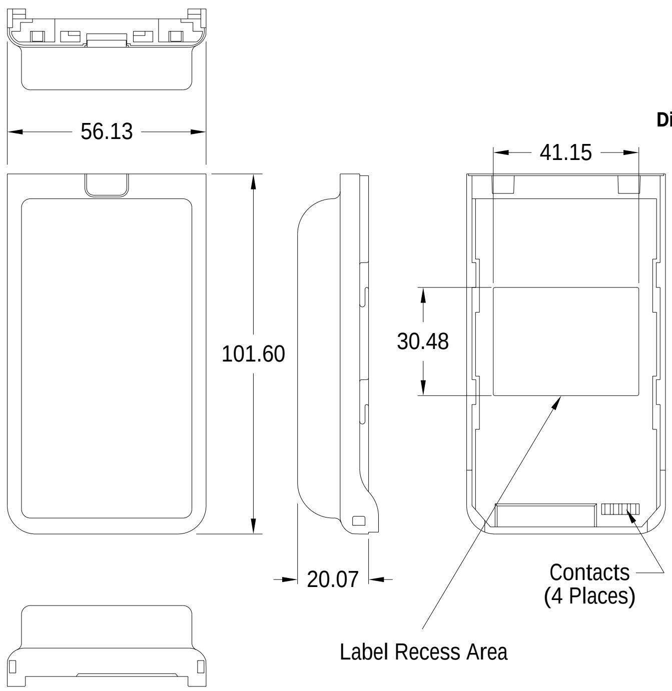
Engineering Data

ENERGIZER NO. CP2360

Designation: NiMH Cellular Phone Battery
For Nokia 2100 series

Nominal Voltage: 6.0 VDC
Typical Capacity: 1800 mAh
Typical Weight: - grams (- oz.)



Dimensions (mm)

Millimeters	Inches
20.07	.790
30.48	1.200
41.15	1.620
56.13	2.210
101.60	4.000

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Eveready Battery Company, Inc.

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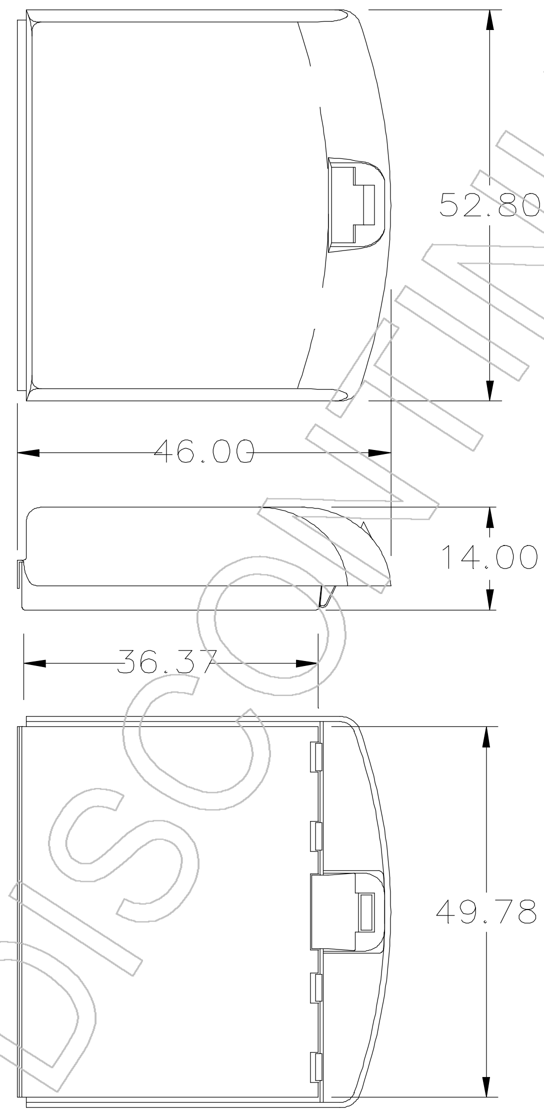
Engineering Data

ENERGIZER NO. CP3336

Dimensions (MM)



Designation: Lithium Cellular Phone Battery
For Motorola i1000
Nominal Voltage: 3.6 VDC
Typical Capacity: 950 mAh
Typical Weight: 47.5 grams (1.7 oz.)

Millimeters	Inches
14.00	0.551
36.37	1.432
46.00	1.811
49.78	1.960
52.80	2.079

DISCONTINUED

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Eveready Battery Company, Inc.

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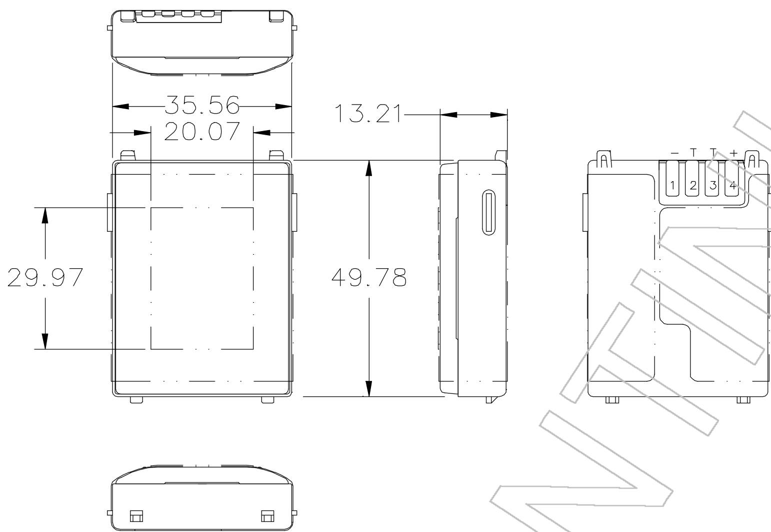
Engineering Data

ENERGIZER NO. CP3536



Designation: Lithium Cellular Phone Battery
For Motorola "V" type phone
Nominal Voltage: 3.6 VDC
Typical Capacity: 1040 mAh
Typical Weight: 120 grams (.265 lbs.)

Dimensions (mm)

Millimeters	Inches
13.21	0.520
20.07	0.790
29.97	1.180
35.56	1.400
49.78	1.960

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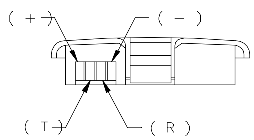
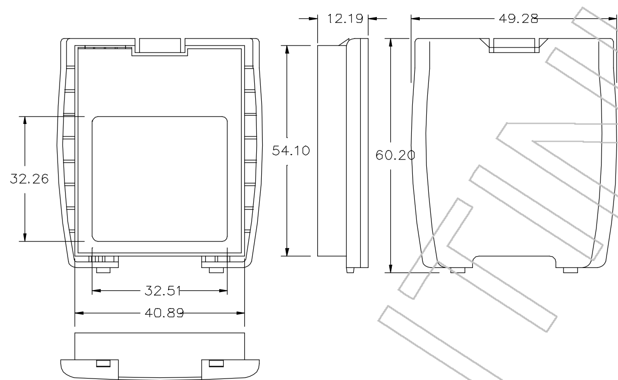
Engineering Data

ENERGIZER NO. CP3736



Designation: Litium Ion Battery
For Sprint PCS / Denso Touchpoint phone
Nominal Voltage: 3.6 VDC
Typical Capacity: 1040 mAh
Typical Weight: 0 grams (0 lbs.)



Dimensions (mm)

Millimeters	Inches
12.19	0.480
32.26	1.270
32.51	1.280
40.89	1.610
49.28	1.940
54.10	2.130
60.20	2.370

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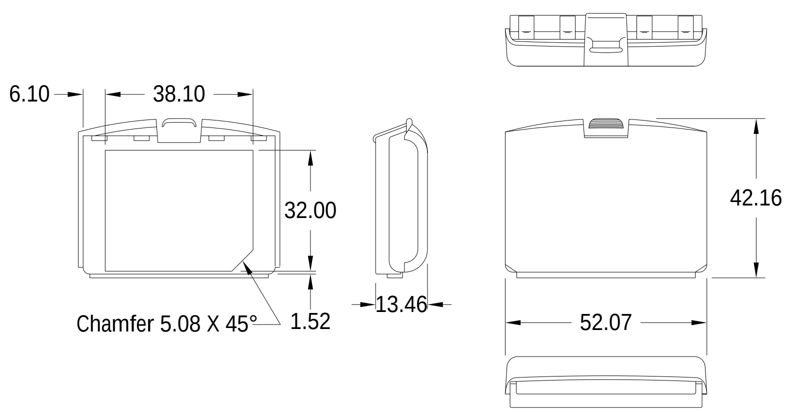
Engineering Data

ENERGIZER NO. CP5036

Designation: NiMH Cellular Phone Battery
For Motorola Startac series

Nominal Voltage: 3.6 VDC
Typical Capacity: 600 mAh
Typical Weight: 50 grams (1.8 oz.)

Dimensions (mm)



Millimeters	Inches
1.52	.060
5.08	.200
6.10	.240
13.46	.530
32.00	1.260
38.10	1.500
42.16	1.660
52.07	2.050

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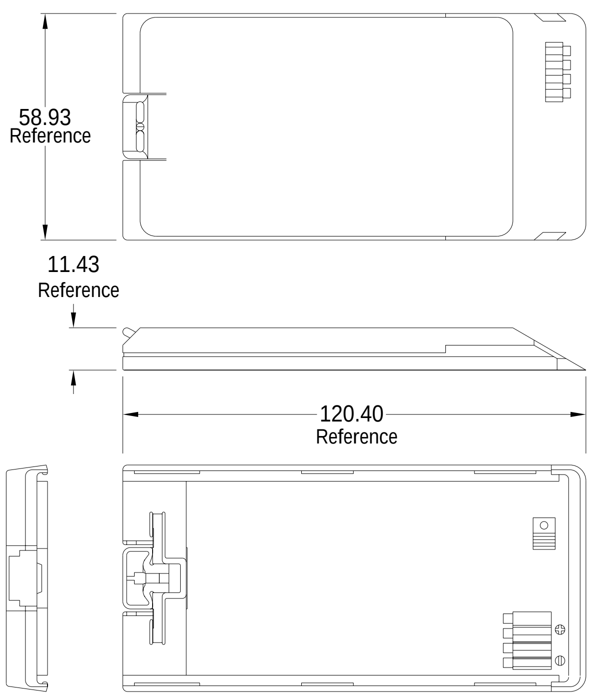
Engineering Data

ENERGIZER NO. CP5160

Designation: NiMH Cellular Phone Battery
For Motorola Micro Tac series

Nominal Voltage: 6 VDC
Typical Capacity: 600 mAh
Typical Weight: 118.9 grams (4.2 oz.)



Dimensions (mm)

Millimeters	Inches
11.43	.450
58.93	2.320
120.40	4.740

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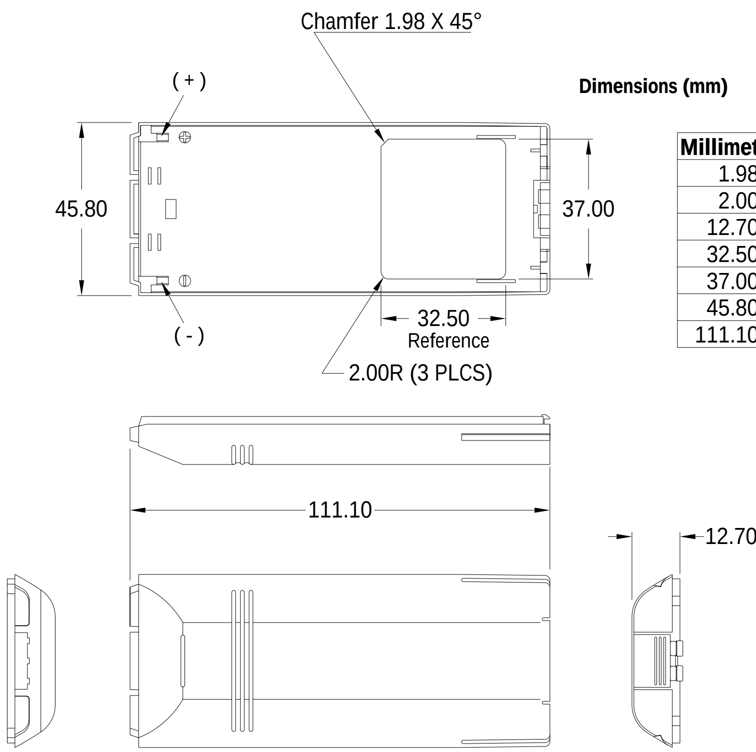
Engineering Data

ENERGIZER NO. CP5648

Designation: NiMH Cellular Phone Battery
For Ericsson 600 series

Nominal Voltage: 4.8 VDC
Typical Capacity: 600 mAh
Typical Weight: 68 grams (2.4 oz.)



Dimensions (mm)

Millimeters	Inches
1.98	.078
2.00	.079
12.70	.500
32.50	1.280
37.00	1.457
45.80	1.803
111.10	4.370

IMPORTANT NOTICE

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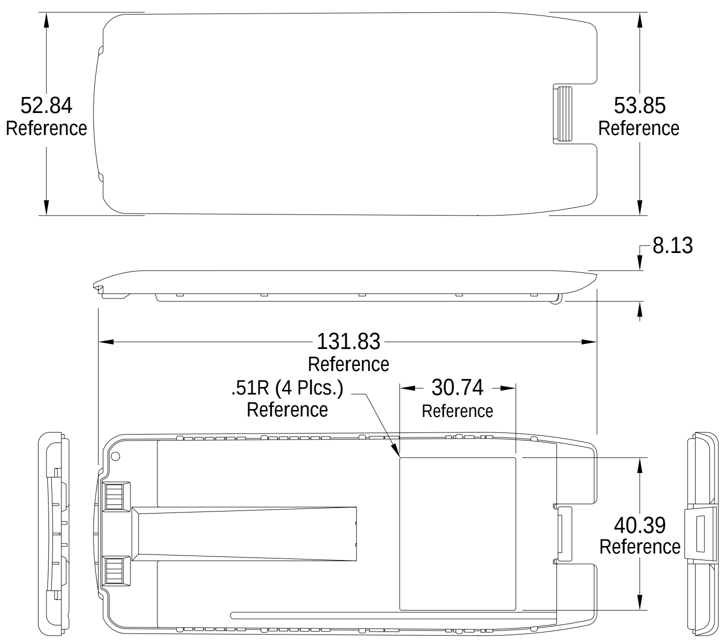
Engineering Data

ENERGIZER NO. CP5960

Designation: NiMH Cellular Phone Battery
For Nokia 232

Nominal Voltage: 6 VDC
Typical Capacity: 550 mAh
Typical Weight: 108.9 grams (3.9 oz.)

Dimensions (mm)



Millimeters	Inches
.51	.020
8.13	.320
30.74	1.210
40.39	1.590
52.84	2.080
53.85	2.120
131.83	5.190

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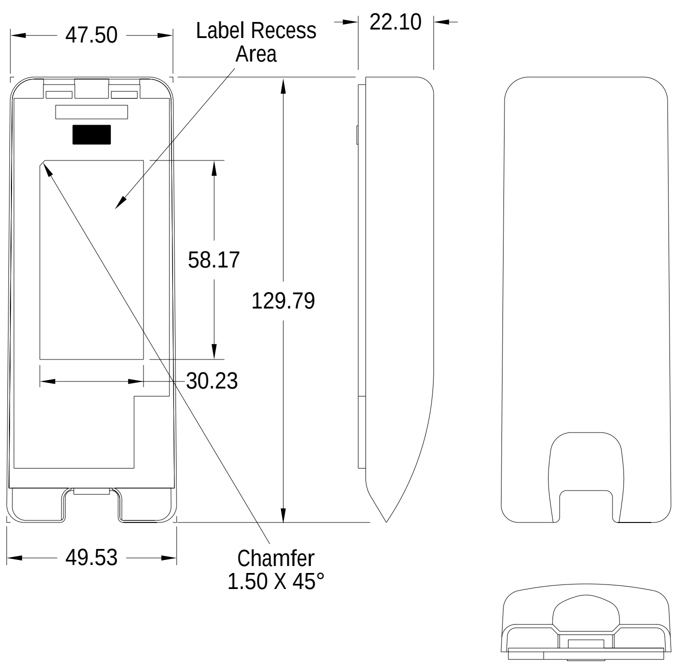
Engineering Data

ENERGIZER NO. CP6072

Designation: Lithium Cellular Phone Battery
For Sony CMB3200 series

Nominal Voltage: 7.2 VDC
Typical Capacity: 1500 mAh
Typical Weight: 110 grams (3.9 oz.)



Dimensions (mm)

Millimeters	Inches
1.50	.059
22.10	.870
30.23	1.190
47.50	1.870
49.53	1.950
58.17	2.290
129.79	5.110

IMPORTANT NOTICE

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Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP6172

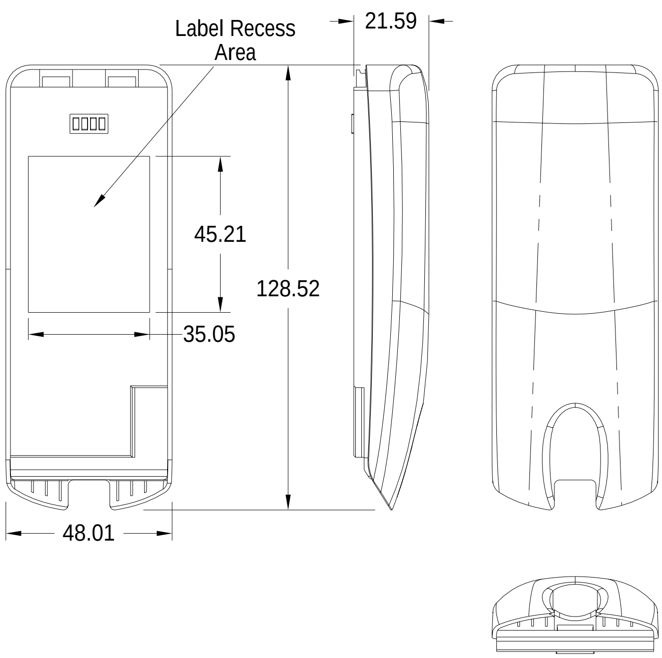
Designation: Lithium Cellular Phone Battery
For Qualcomm QCP-820 / 1920 / 2700

Nominal Voltage: 7.2 VDC

Typical Capacity: 1500 mAh

Typical Weight: 110 grams (3.9 oz.)

Dimensions (mm)



Millimeters	Inches
21.59	.850
35.05	1.380
45.21	1.780
48.01	1.890
128.52	5.060

IMPORTANT NOTICE

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Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

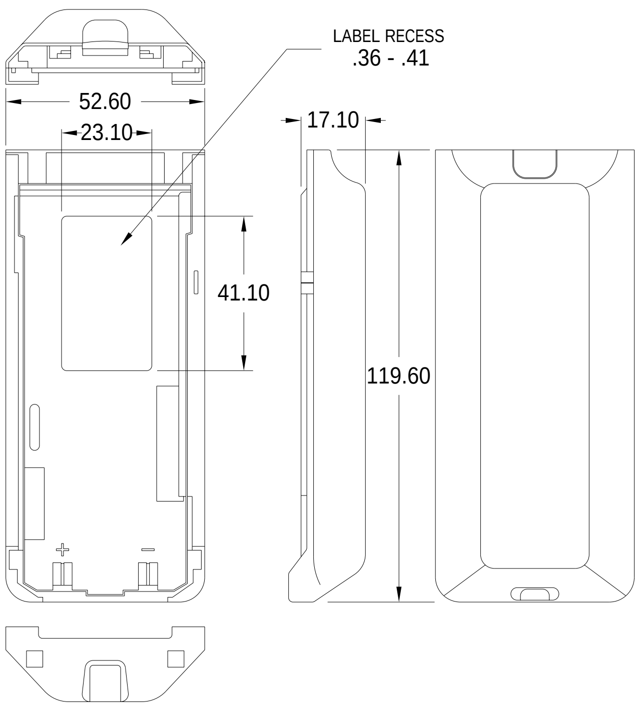
Engineering Data

ENERGIZER NO. CP7049

Designation: NiCd Cellular Phone Battery
For Nokia 918 series

Nominal Voltage: 4.8 VDC
Typical Capacity: 800 mAh
Typical Weight: 120.2 grams (4.3 oz.)

Dimensions (mm)



Millimeters	Inches
.36	.118
.41	.343
17.10	.819
23.10	.906
41.10	1.476
52.60	1.614
119.60	2.126

IMPORTANT NOTICE

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Energizer

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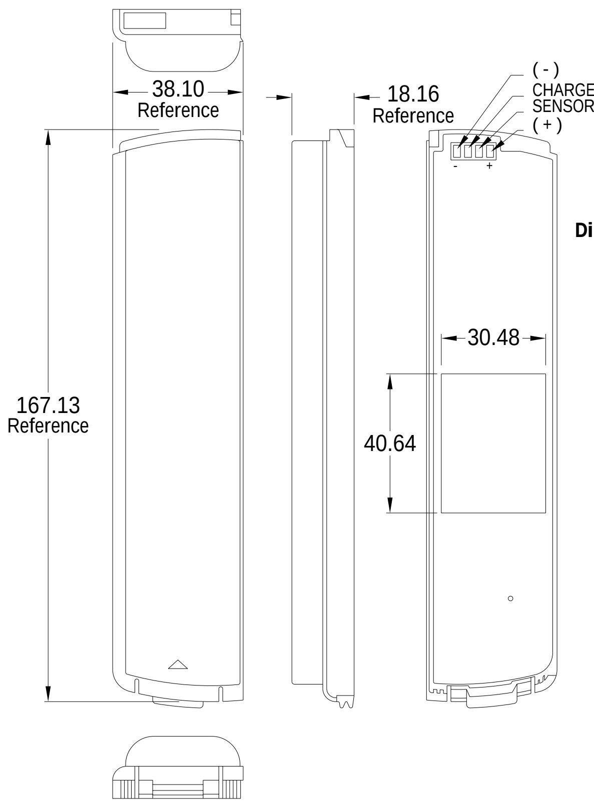
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP7072

Designation: NiCd Cellular Phone Battery
For Nokia 101

Nominal Voltage: 7.2 VDC
Typical Capacity: 800 mAh
Typical Weight: 170 grams (6.0 oz.)



Dimensions (mm)

Millimeters	Inches
18.16	.714
30.48	1.200
38.10	1.500
40.64	1.600
167.13	6.580

IMPORTANT NOTICE

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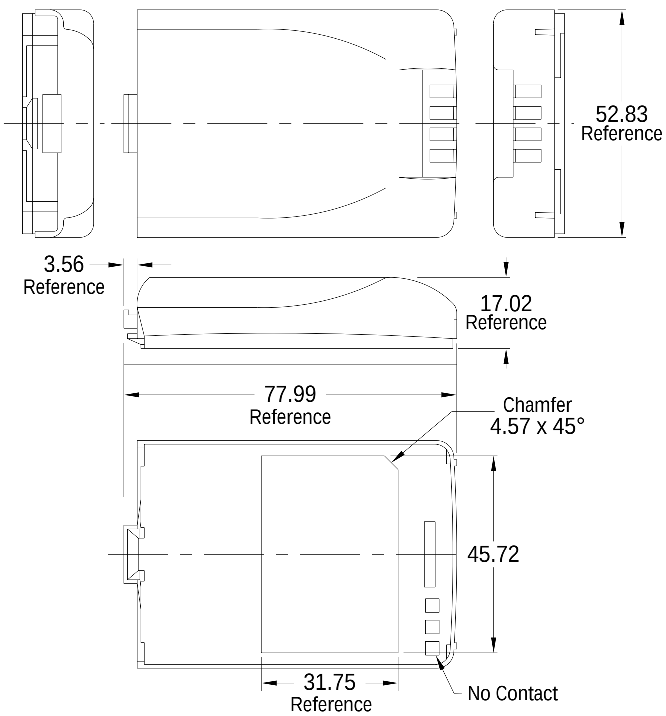
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP7148

Designation: NiCd Cellular Phone Battery
For Audiovox MVX-700

Nominal Voltage: 4.8 VDC
Typical Capacity: 800 mAh
Typical Weight: 113.3 grams (4.0 oz.)



Dimensions (mm)

Millimeters	Inches
3.56	.140
4.57	.180
17.02	.670
31.75	1.250
45.72	1.800
52.83	2.080
77.99	3.070

IMPORTANT NOTICE

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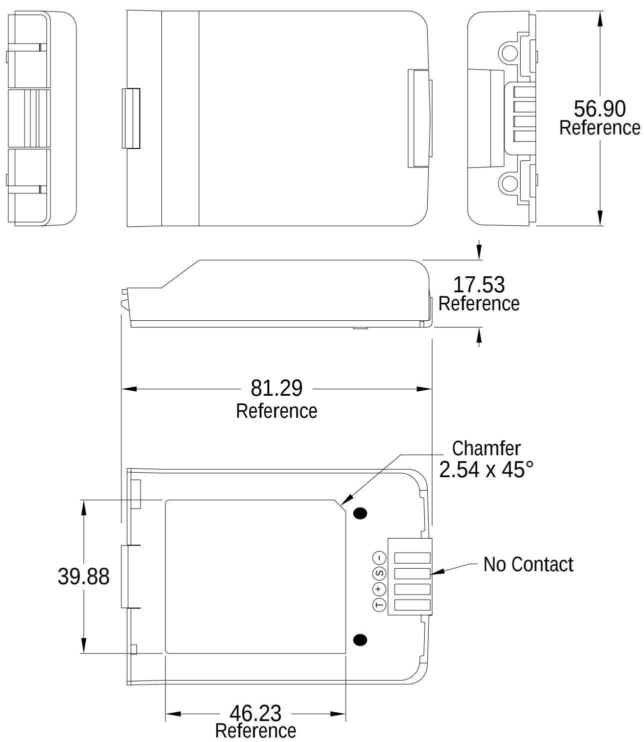
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP7149

Designation: NiCd Cellular Phone Battery
For Audiovox 405/406

Nominal Voltage: 4.8 VDC
Typical Capacity: 800 mAh
Typical Weight: 94.3 grams (3.3 oz.)



Dimensions (mm)

Millimeters	Inches
2.54	.100
17.53	.690
39.88	1.570
46.23	1.820
56.90	2.240
81.29	3.200

IMPORTANT NOTICE

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Checkerboard Square
St. Louis, MO 63164
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Internet: www.energizer.com

Engineering Data

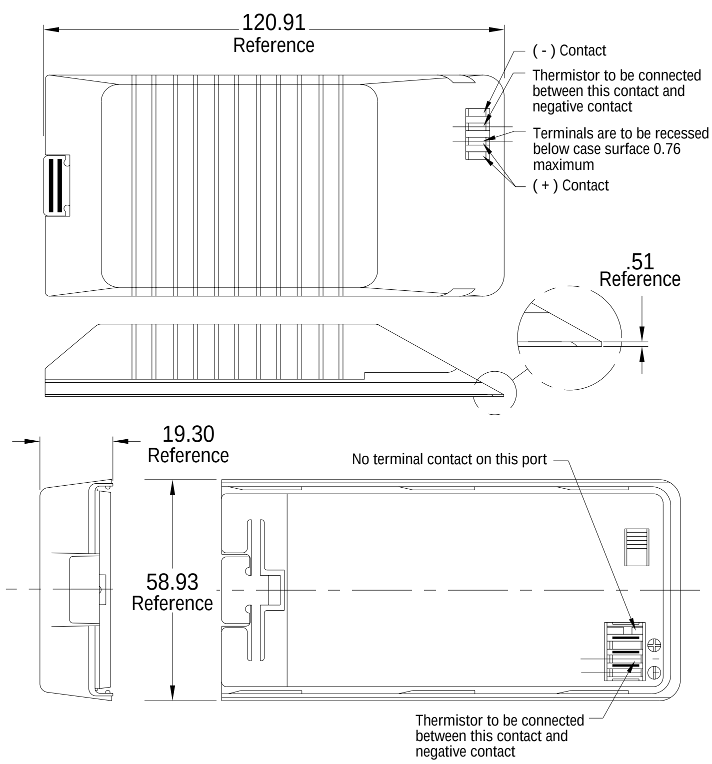
ENERGIZER NO. CP7160

Designation: NiCd Cellular Phone Battery For Motorola Micro Tac

Nominal Voltage: 6 VDC

Typical Capacity: 800 mAh

Typical Weight: 151.1 grams (5.3 oz.)



Dimensions (mm)

Millimeters	Inches
.51	.020
.76	.030
19.31	.760
58.93	2.320
120.91	4.760

IMPORTANT NOTICE

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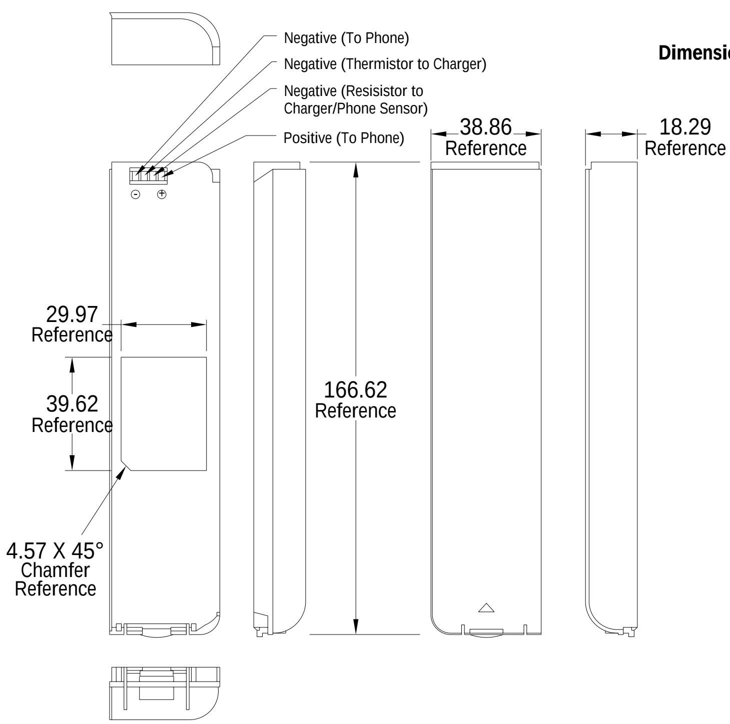
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP7172

Designation: NiCd Cellular Phone Battery
For Nokia 100/105

Nominal Voltage: 7.2 VDC
Typical Capacity: 800 mAh
Typical Weight: 161.6 grams (5.7 oz.)



Dimensions (mm)

Millimeters	Inches
4.57	.180
18.29	.720
29.97	1.180
38.86	1.530
39.62	1.560
166.62	6.560

IMPORTANT NOTICE

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Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

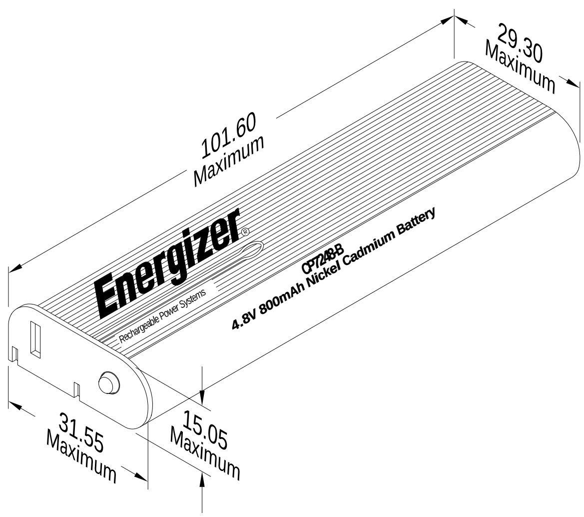
Engineering Data

ENERGIZER NO. CP7248

Designation: NiCD Cellular Phone Battery
For -

Nominal Voltage: 4.8 VDC
Typical Capacity: 800 mAh
Typical Weight: 93 grams (3.3 oz.)

Dimensions (mm)



Millimeters	Inches
15.05	.593
29.30	1.154
31.55	1.242
101.60	4.000

IMPORTANT NOTICE

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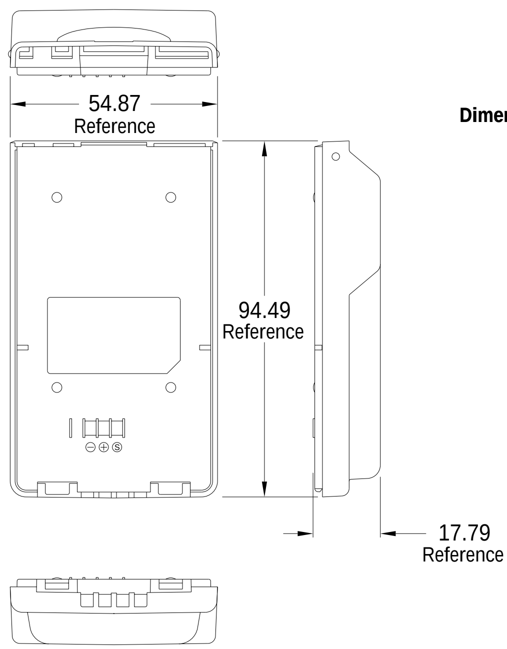
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP7261

Designation: NiCd Cellular Phone Battery
For Mitsubishi 4000

Nominal Voltage: 6 VDC
Typical Capacity: 800 mAh
Typical Weight: 135 grams (4.8 lbs.)



Dimensions (mm)

Millimeters	Inches
17.79	.700
54.87	2.160
94.49	3.720

IMPORTANT NOTICE

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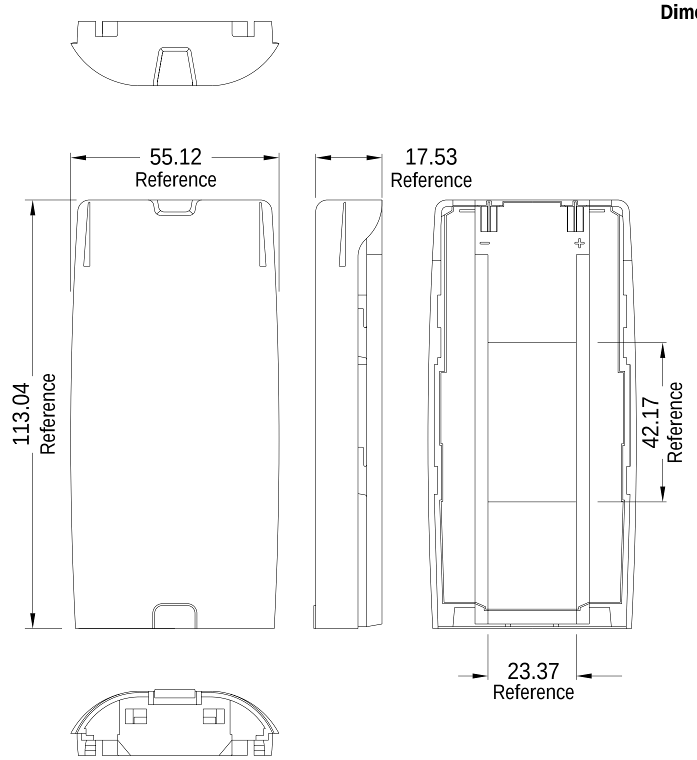
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP7348

Designation: NiCd Cellular Phone Battery
For Nokia 638/368

Nominal Voltage: 4.8 VDC
Typical Capacity: 800 mAh
Typical Weight: 116.7 grams (4.1 oz.)



Dimensions (mm)

Millimeters	Inches
17.53	.690
23.37	.920
42.17	1.660
55.12	2.170
113.04	4.460

IMPORTANT NOTICE

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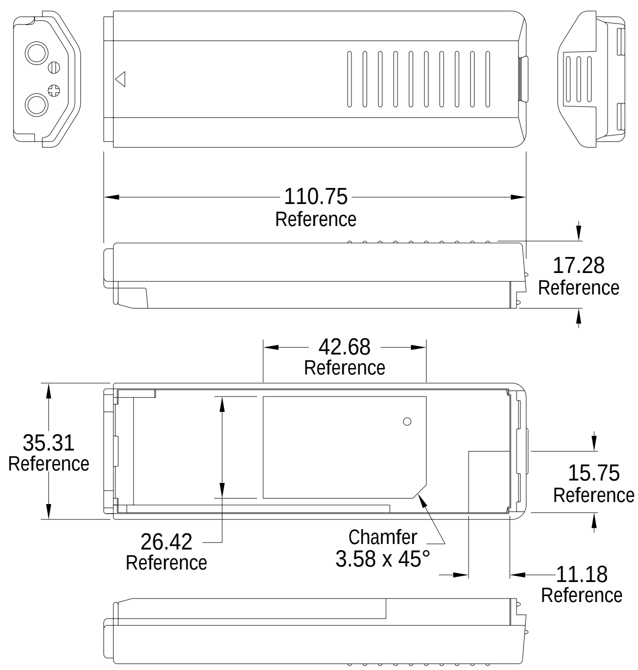
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP7548

Designation: NiCd Cellular Phone Battery
For Mitsubishi AH-129

Nominal Voltage: 4.8 VDC
Typical Capacity: 800 mAh
Typical Weight: 106.6 grams (3.8 oz.)



Dimensions (mm)

Millimeters	Inches
3.58	.141
11.18	.440
15.75	.620
17.28	.680
26.42	1.040
35.31	1.390
42.68	1.680
110.75	4.360

IMPORTANT NOTICE

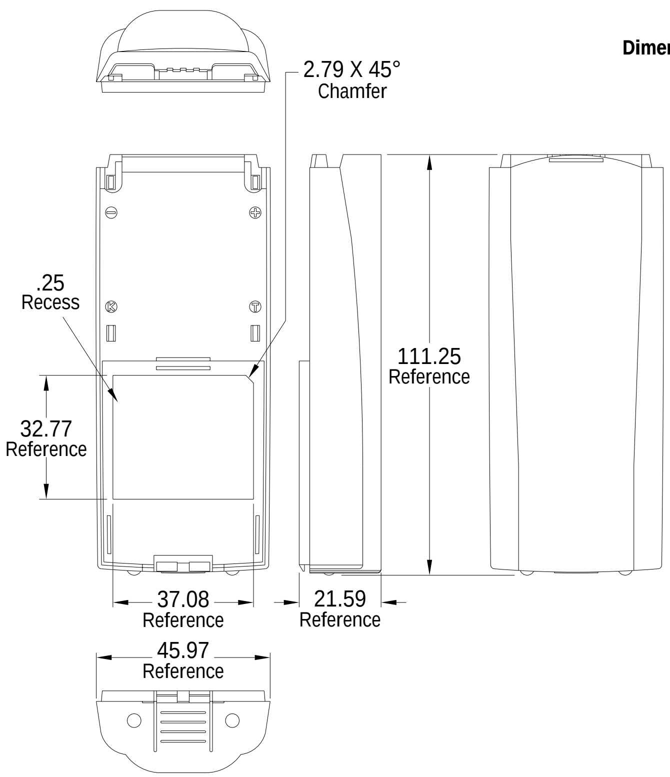
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP7661

Designation: NiCd Cellular Phone Battery
For GE CT-700, Ericsson AH 237

Nominal Voltage: 6 VDC
Typical Capacity: 800 mAh
Typical Weight: 141.8 grams (5.0 oz.)



Dimensions (mm)

Millimeters	Inches
.25	.010
2.79	.110
21.59	.850
32.77	1.290
37.08	1.460
45.97	1.810
111.25	4.380

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Checkerboard Square
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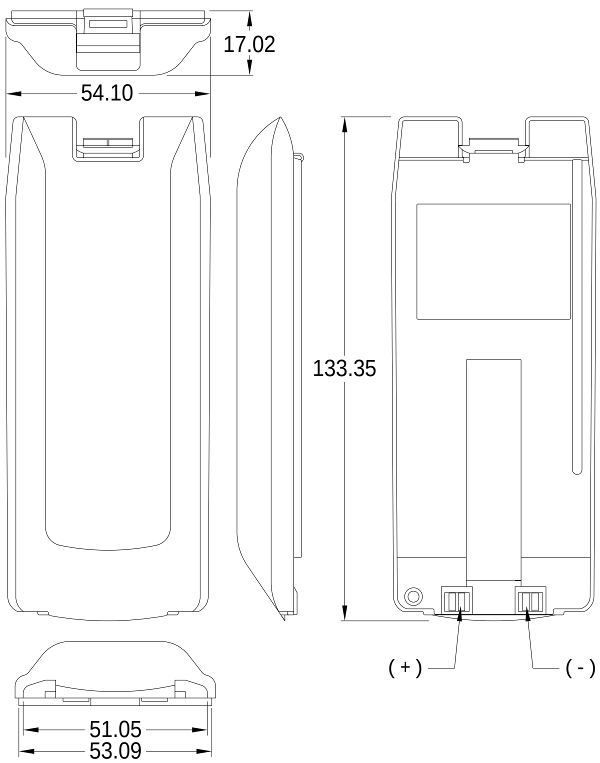
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP7960

Designation: NiCd Cellular Phone Battery
For Nokia 232

Nominal Voltage: 6 VDC
Typical Capacity: 800 mAh
Typical Weight: 146 grams (5.2 lbs.)



Dimensions (mm)

Millimeters	Inches
17.02	.670
51.05	2.010
53.09	2.090
54.10	2.130
133.35	5.250

IMPORTANT NOTICE

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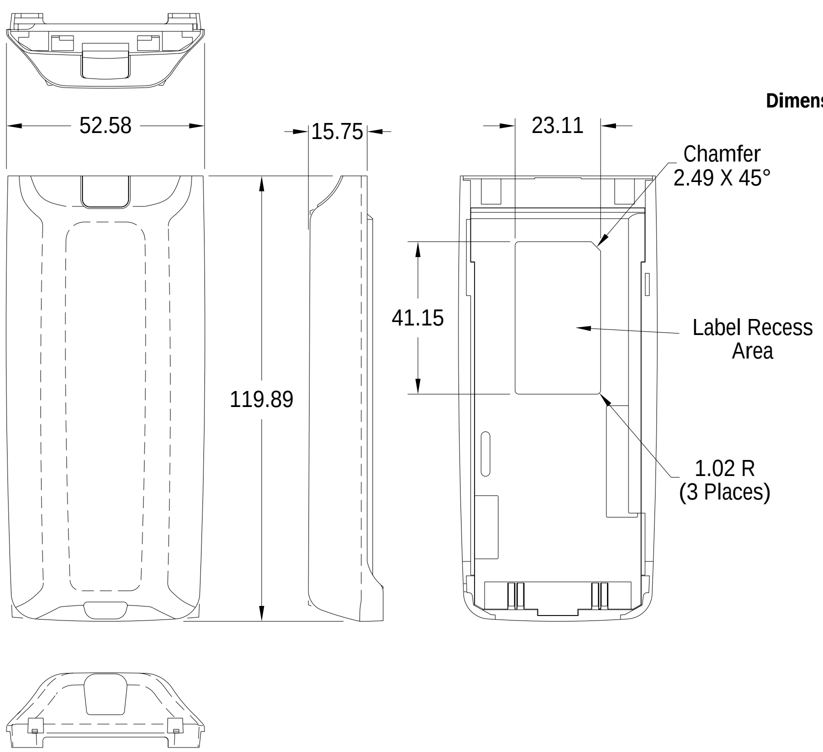
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP8049

Designation: NiMH Cellular Phone Battery
For Nokia 918 series

Nominal Voltage: 4.8 VDC
Typical Capacity: 1200 mAh
Typical Weight: - grams (- oz.)



Dimensions (mm)

Millimeters	Inches
1.02	.040
2.49	.098
15.75	.620
23.11	.910
41.15	1.620
52.58	2.070
119.89	4.720

IMPORTANT NOTICE

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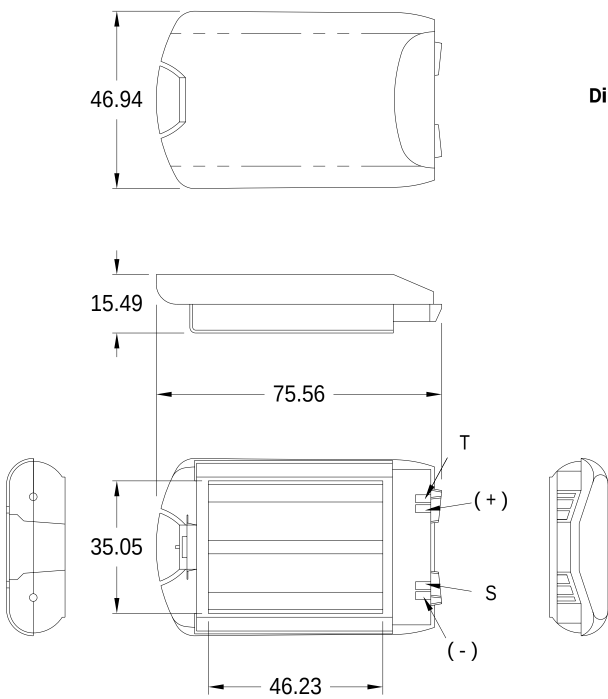
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP8136

Designation: NiMH Cellular Phone Battery
For Nokia 252 series

Nominal Voltage: 3.6 VDC
Typical Capacity: 1200 mAh
Typical Weight: 89 grams (3.2 oz.)



Dimensions (mm)

Millimeters	Inches
15.49	.610
35.05	1.380
46.23	1.820
46.94	1.848
75.56	2.975

IMPORTANT NOTICE

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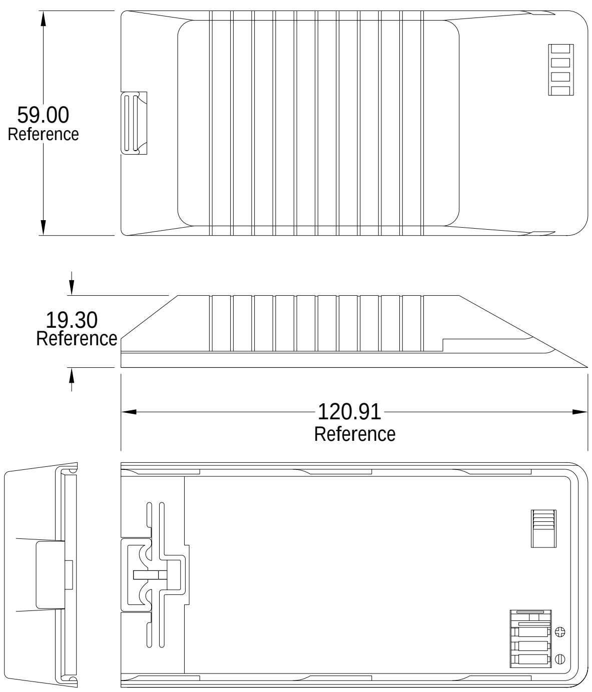
Engineering Data

ENERGIZER NO. CP8160

Designation: NiMH Cellular Phone Battery
For Motorola MicroTac series

Nominal Voltage: 6 VDC
Typical Capacity: 1200 mAh
Typical Weight: 167.3 grams (5.9 oz.)



Dimensions (mm)

Millimeters	Inches
19.30	.760
59.00	2.323
120.91	4.760

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

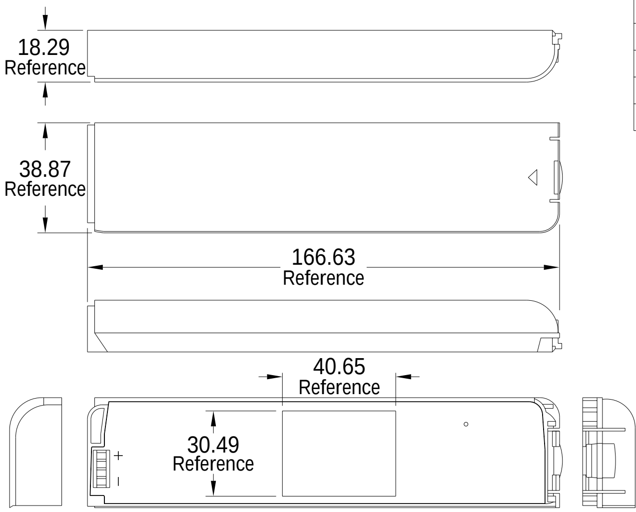
Engineering Data

ENERGIZER NO. CP8172

Designation: NiMH Cellular Phone Battery
For Nokia 100

Nominal Voltage: 7.2 VDC
Typical Capacity: 1100 mAh
Typical Weight: 195.2 grams (6.9 oz.)

Dimensions (mm)



Millimeters	Inches
18.29	.720
30.49	1.200
38.87	1.530
40.65	1.600
166.63	6.560

IMPORTANT NOTICE

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Energizer

Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

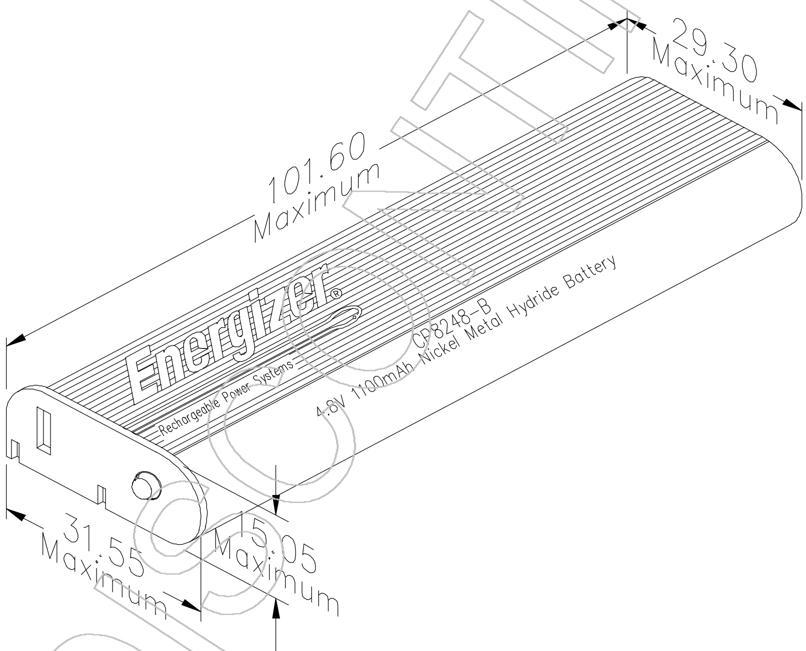
ENERGIZER NO. CP8248

Dimensions (MM)

Designation: NiMH Cellular Phone Battery

Nominal Voltage: 4.8 VDC
Typical Capacity: 1100 mAh
Typical Weight: 113 grams (4.0 oz.)

Millimeters	Inches
15.05	0.593
29.30	1.154
31.55	1.242
101.60	4.000



Important Notice

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Energizer

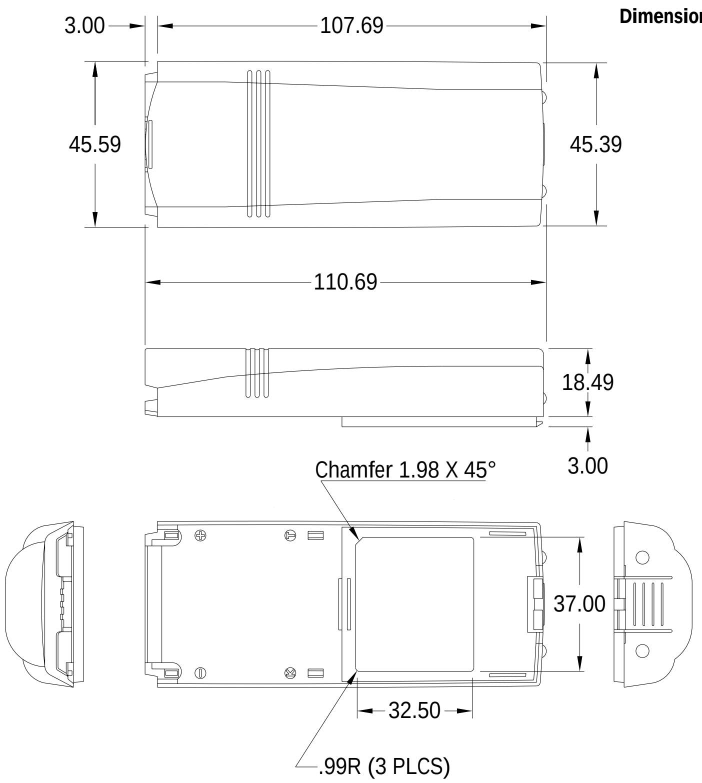
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP8661

Designation: NiMH Cellular Phone Battery
For GE CT-700 series

Nominal Voltage: 6 VDC
Typical Capacity: 1200 mAh
Typical Weight: 154 grams (5.5 oz.)



Dimensions (mm)

Millimeters	Inches
.99	.039
1.98	.078
3.00	.118
18.49	.728
32.50	1.280
37.00	1.457
45.39	1.787
45.59	1.795
107.69	4.236
110.69	4.358

IMPORTANT NOTICE

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Checkerboard Square
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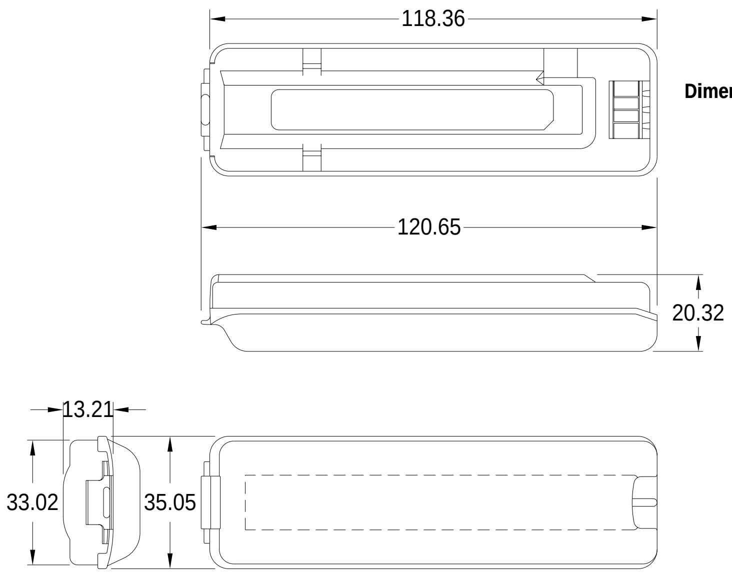
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP8748

Designation: NiMH Cellular Phone Battery
For Panasonic EBH63/65 series

Nominal Voltage: 4.8 VDC
Typical Capacity: 1200 mAh
Typical Weight: 121 grams (4.3 oz.)



Dimensions (mm)

Millimeters	Inches
13.21	.520
20.32	.800
33.02	1.300
35.05	1.380
118.36	4.660
120.65	4.750

IMPORTANT NOTICE

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Checkerboard Square
St. Louis, MO 63164
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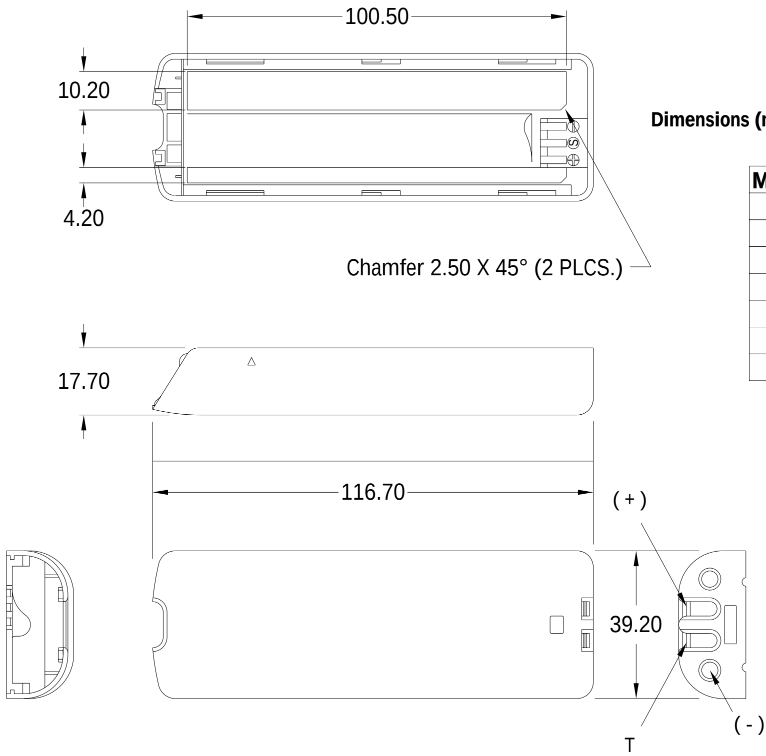
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP8948

Designation: NiMH Cellular Phone Battery
For Sony CMH 777 series

Nominal Voltage: 4.8 VDC
Typical Capacity: 1200 mAh
Typical Weight: 123 grams (4.4 oz.)



Dimensions (mm)

Millimeters	Inches
2.50	.098
4.20	.165
10.20	.420
17.70	.700
39.20	1.543
100.50	3.957
116.70	4.594

IMPORTANT NOTICE

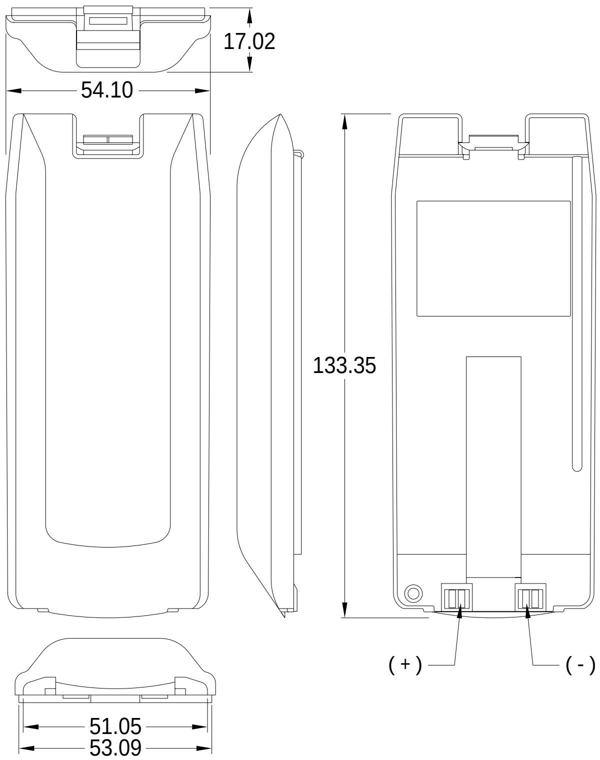
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP8960

Designation: NiMH Cellular Phone Battery
For Nokia 232

Nominal Voltage: 6 VDC
Typical Capacity: 1200 mAh
Typical Weight: 156 grams (5.5 lbs.)



Dimensions (mm)

Millimeters	Inches
17.02	.670
51.05	2.010
53.09	2.090
54.10	2.130
133.35	5.250

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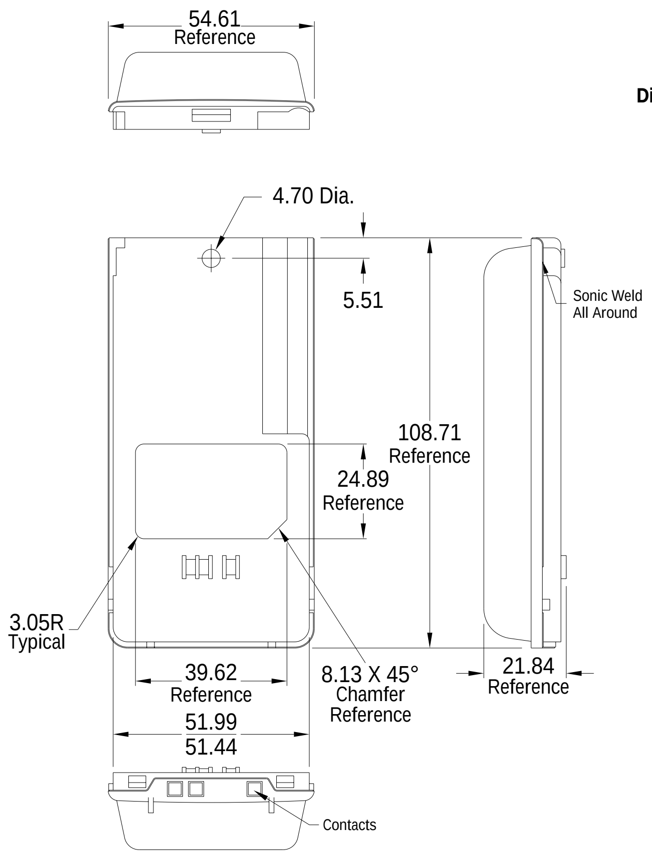
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP9061

Designation: NiCd Cellular Phone Battery
For OKI 1150

Nominal Voltage: 6 VDC
Typical Capacity: 1200 mAh
Typical Weight: 158 grams (5.6 oz.)



Dimensions (mm)

Millimeters	Inches
4.70	.185
5.51	.217
8.13	.320
21.84	.860
24.89	.980
39.62	1.560
51.44	2.025
51.99	2.047
54.61	2.150
108.71	4.280

IMPORTANT NOTICE

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St. Louis, MO 63164
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Internet: www.energizer.com

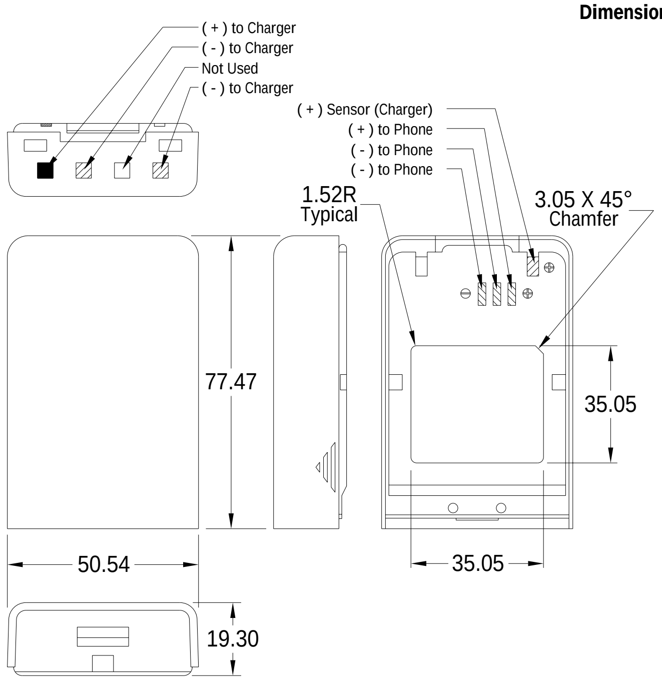
Engineering Data

ENERGIZER NO. CP9148

Designation: NiCd Cellular Phone Battery
For NEC P-700

Nominal Voltage: 4.8 VDC
Typical Capacity: 1200 mAh
Typical Weight: 128.3 grams (4.5 oz.)

Dimensions (mm)



Millimeters	Inches
1.52	.060
3.05	.120
19.30	.760
35.05	1.380
50.54	1.990
77.47	3.050

IMPORTANT NOTICE

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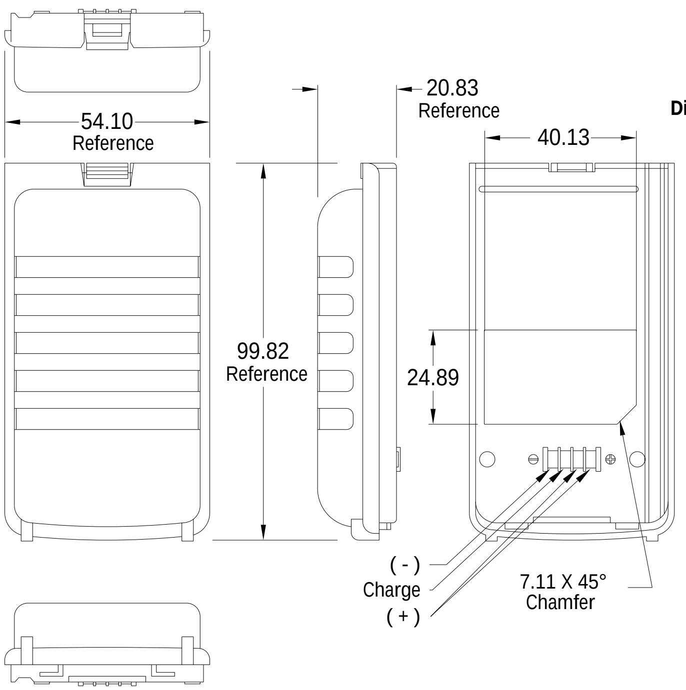
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP9161

Designation: NiCd Cellular Phone Battery
For OKI 1325/1335

Nominal Voltage: 6 VDC
Typical Capacity: 1200 mAh
Typical Weight: 156.2 grams (5.5 oz.)



Dimensions (mm)

Millimeters	Inches
7.11	.280
20.83	.820
24.89	.980
40.13	1.580
54.10	2.130
99.82	3.930

IMPORTANT NOTICE

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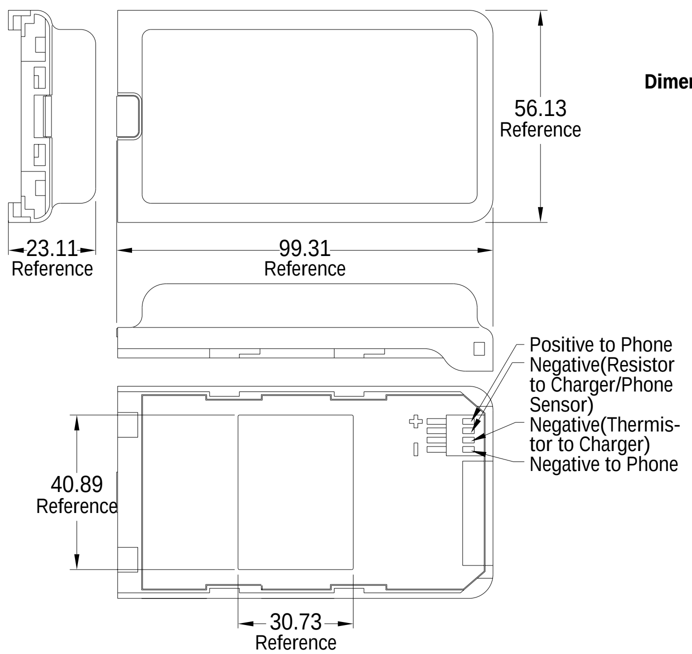
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CP9360

Designation: NiCd Cellular Phone Battery
For Nokia 2120

Nominal Voltage: 6 VDC
Typical Capacity: 1200 mAh
Typical Weight: 167.5 grams (5.9 oz.)



Dimensions (mm)

Millimeters	Inches
23.11	.910
30.73	1.210
40.89	1.610
56.13	2.210
99.31	3.910

IMPORTANT NOTICE

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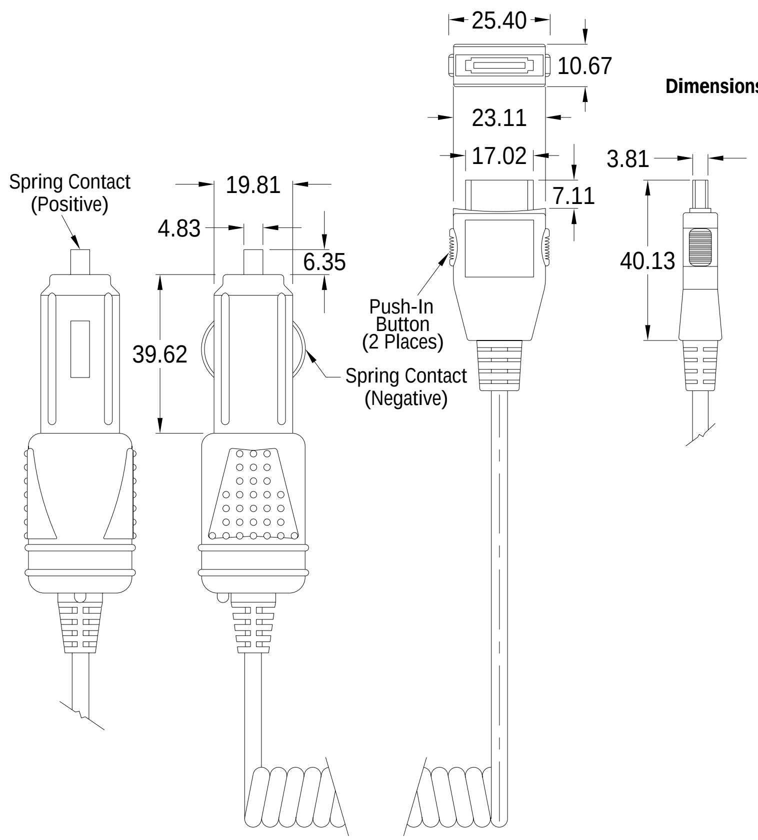
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER MODEL NO. CS3336

Charger Saver

Designation: Charger Saver for Cellular Phone System
For MOTOROLA iDEN i1000 series
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 8.58 VDC @ 700 mA
Typical Cord Length: 610 mm (24 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: - grams (- oz.)



Dimensions (mm)

Millimeters	Inches
3.81	.150
4.83	.190
6.35	.250
7.11	.280
10.67	.420
17.02	.670
19.81	.780
23.11	.910
25.40	1.000
39.62	1.560
40.13	1.580

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Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

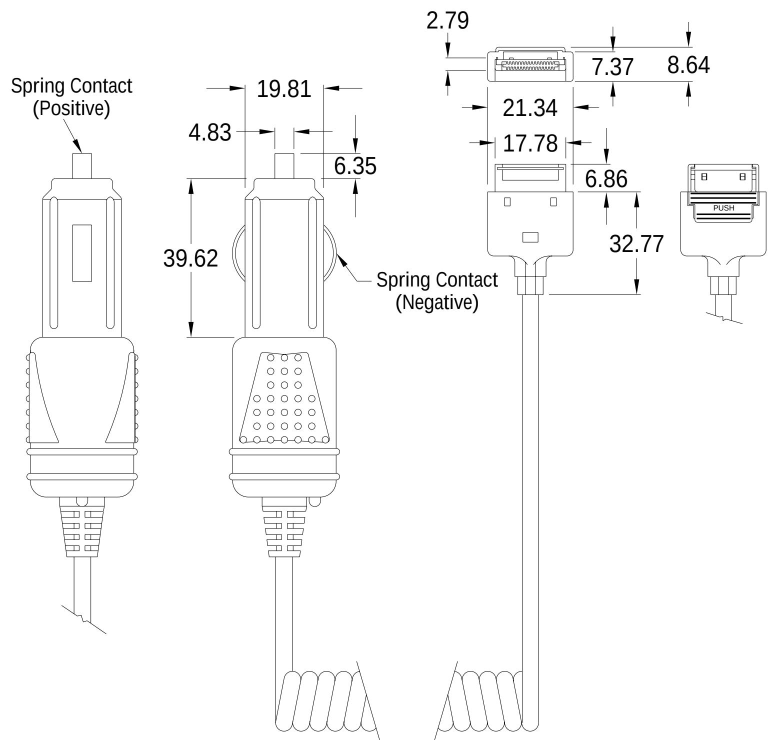
Engineering Data

ENERGIZER MODEL NO. CS5036

Charger Saver

Designation: Charger Saver for Cellular Phone System
For MOTOROLA STARTAC series
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 4.0 VDC @ 700 mA
Typical Cord Length: 610 mm (24 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: 91 grams (3.2 oz.)
Feature: Variable Cigar Lighter Plug

Dimensions (mm)



Millimeters	Inches
2.79	.110
4.83	.190
6.35	.250
6.86	.270
7.37	.290
8.64	.340
17.78	.700
19.81	.780
21.34	.840
32.77	1.290
39.62	1.560

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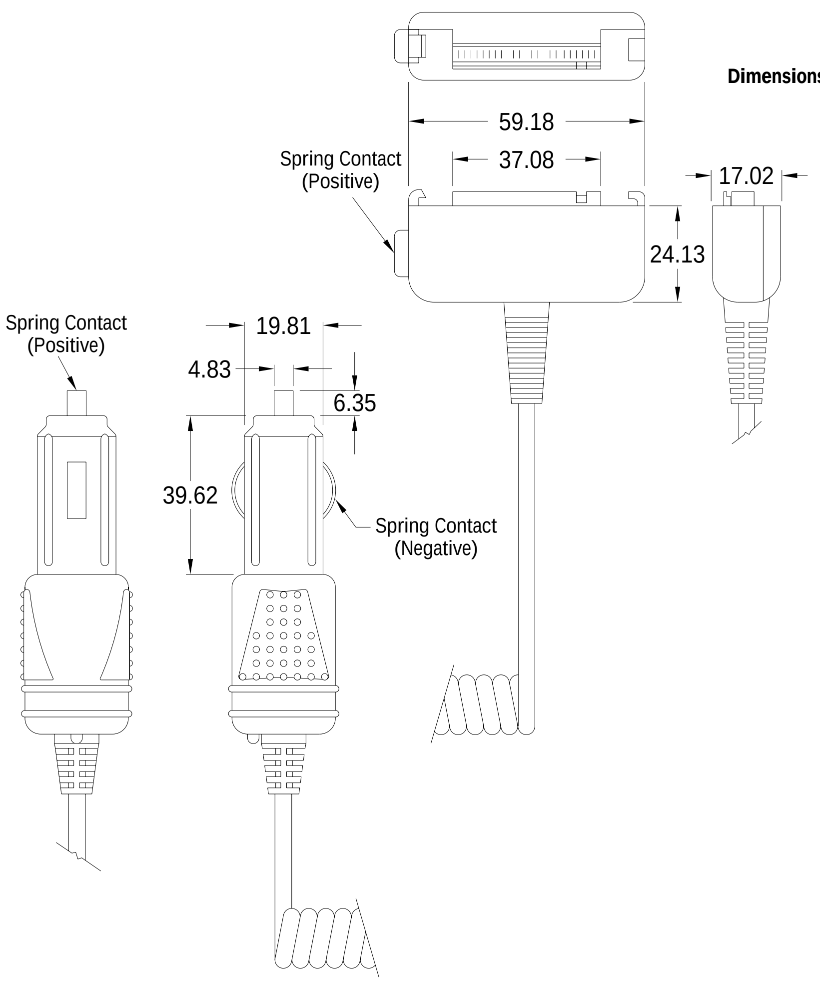
Engineering Data

ENERGIZER MODEL NO. CS5460

Charger Saver

Designation: Charger Saver for Cellular Phone System
For MOTOROLA iDEN i370 / i600
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 8.58 VDC @ 700 mA
Typical Cord Length: 610 mm (24 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: - grams (- oz.)



Dimensions (mm)

Millimeters	Inches
4.83	.190
6.35	.250
17.02	.670
19.81	.780
24.13	.950
37.08	1.460
39.62	1.560
59.18	2.330

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Engineering Data

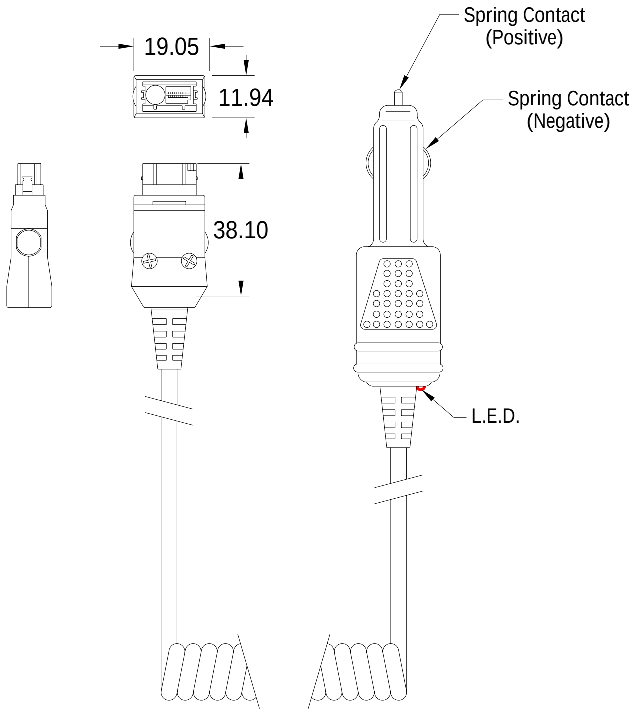
ENERGIZER MODEL NO. CS7048

Charger Saver

Designation: Charger Saver for Cellular Phone System For Sony CM-H333
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 6.5 VDC @ 850 mA
Typical Cord Length: 2743 mm (108 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: 131.3 grams (4.6 oz.)
Feature: Black Cigar Lighter Plug

Dimensions (mm)

Millimeters	Inches
11.94	.470
19.05	.750
38.10	1.500



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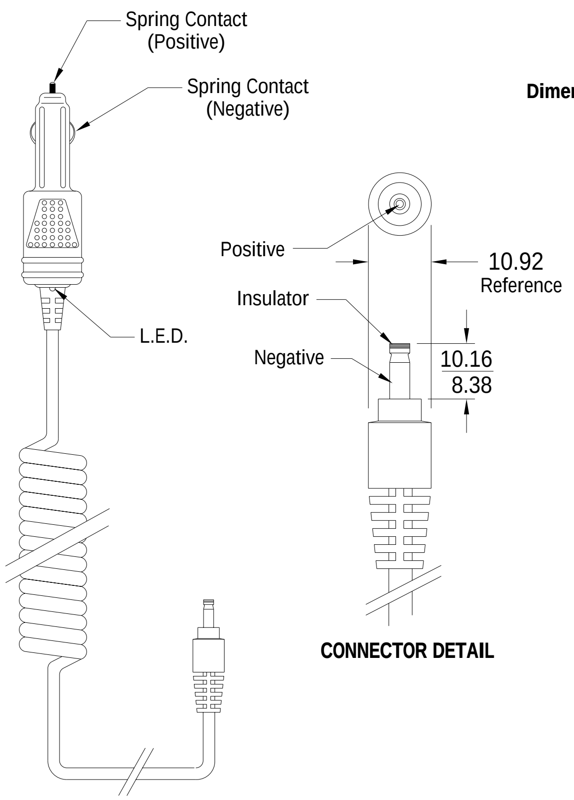
Engineering Data

ENERGIZER MODEL NO. CS7072

Charger Saver

Designation: Charger Saver for Cellular Phone System
For Nokia 100, 101, 232, 2120
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 7.2 VDC @ 500 mA
Typical Cord Length: 2743 mm (108 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: 113.3 grams (4.0 oz.)
Feature: Black Cigar Lighter Plug



CONNECTOR DETAIL

Dimensions (mm)

Millimeters	Inches
8.38	.330
10.16	.400
10.92	.430

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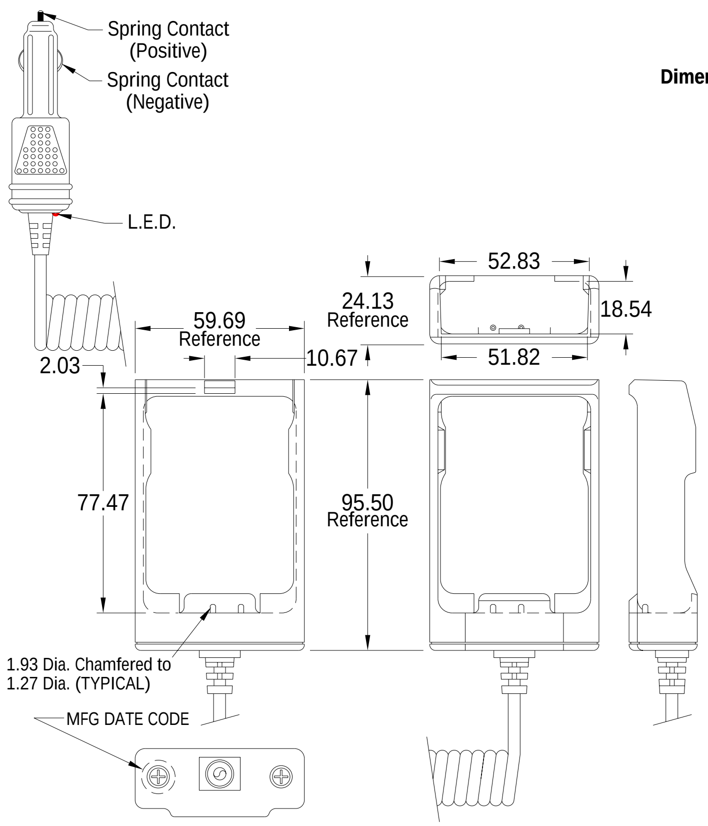
Engineering Data

ENERGIZER MODEL NO. CS7148

Charger Saver

Designation: Charger Saver for Cellular Phone System For Audiovox MVX-700/750
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 4.8 VDC @ 500 mA
Typical Cord Length: 2743 mm (108 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: 111.3 grams (3.9 oz.)
Feature: Black Cigar Lighter Plug



Dimensions (mm)

Millimeters	Inches
1.27	.050
1.93	.076
2.03	.080
10.67	.420
18.54	.730
24.13	.950
51.82	2.040
52.83	2.080
59.69	2.350
77.47	3.050
95.50	3.760

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Engineering Data

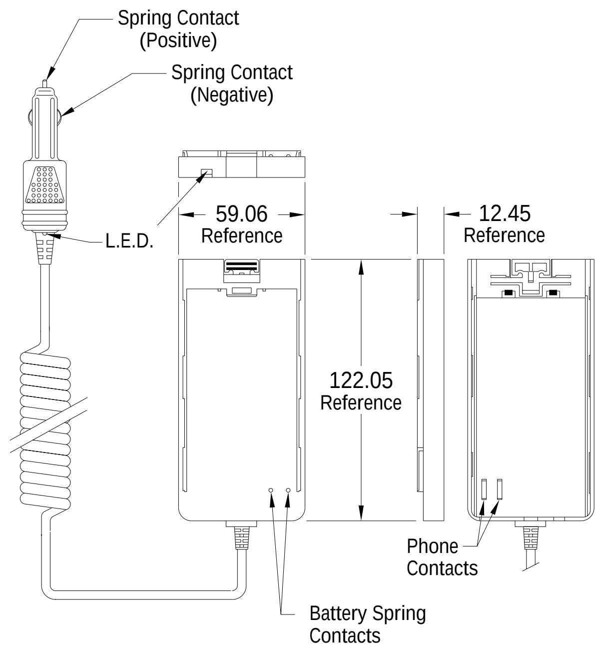
ENERGIZER MODEL NO. CS7160

Charger Saver

Designation: Charger Saver for Cellular Phone System
For Motorola PT-950 (Micro Tac) Cellular Phone
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 6.0 VDC @ 500 mA
Typical Cord Length: 2743 mm (108 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: 141.6 grams (5.0 oz.)
Feature: Black Cigar Lighter Plug

Dimensions (mm)

Millimeters	Inches
12.45	.490
59.06	2.325
122.05	4.805



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Engineering Data

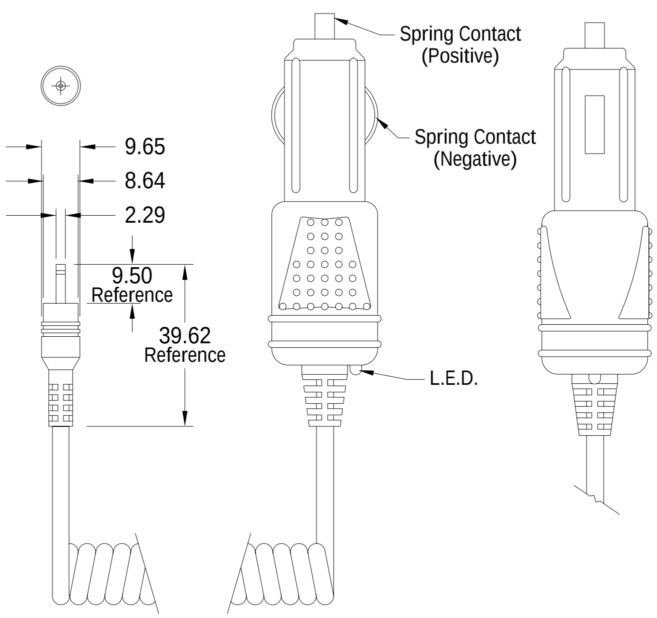
ENERGIZER MODEL NO. CS7248

Charger Saver

Designation: Charger Saver for Cellular Phone System For Motorola
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 6.5 VDC @ 850 mA
Typical Cord Length: 2743 mm (108 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: - grams (- oz.)
Feature: Black Cigar Lighter Plug

Dimensions (mm)

Millimeters	Inches
2.29	.090
8.64	.340
9.50	.374
9.65	.380
39.62	1.560



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Form No. EPS - 6707

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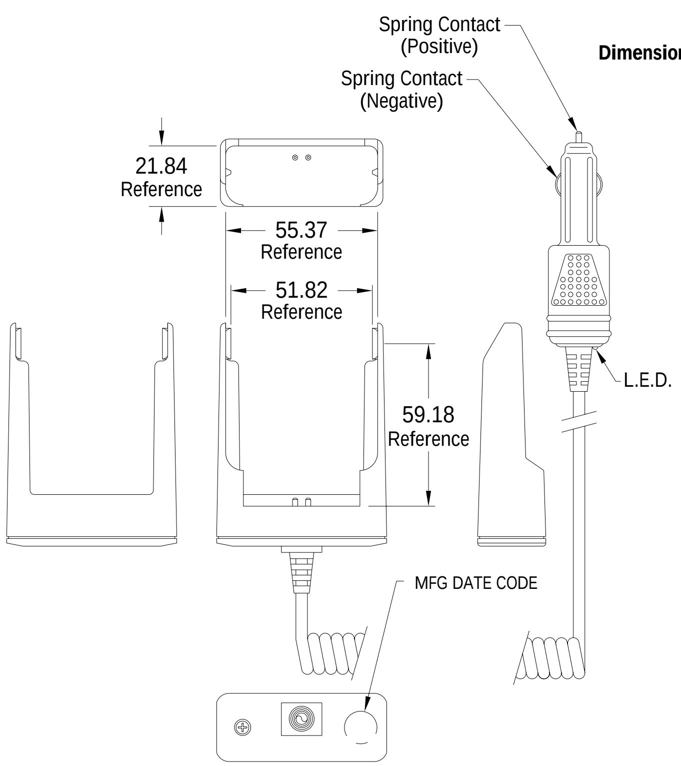
Internet: www.energizer.com

Engineering Data

ENERGIZER MODEL NO. CS7261

Charger Saver

Designation: Charger Saver for Cellular Phone System
For Mitsubishi 4000
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 6.5 VDC
Typical Cord Length: 2743 mm (108 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: 123 grams (4.4 oz.)
Feature: Black Cigar Lighter Plug



Dimensions (mm)

Millimeters	Inches
22.05	.868
51.82	2.040
55.37	2.180
59.18	2.330

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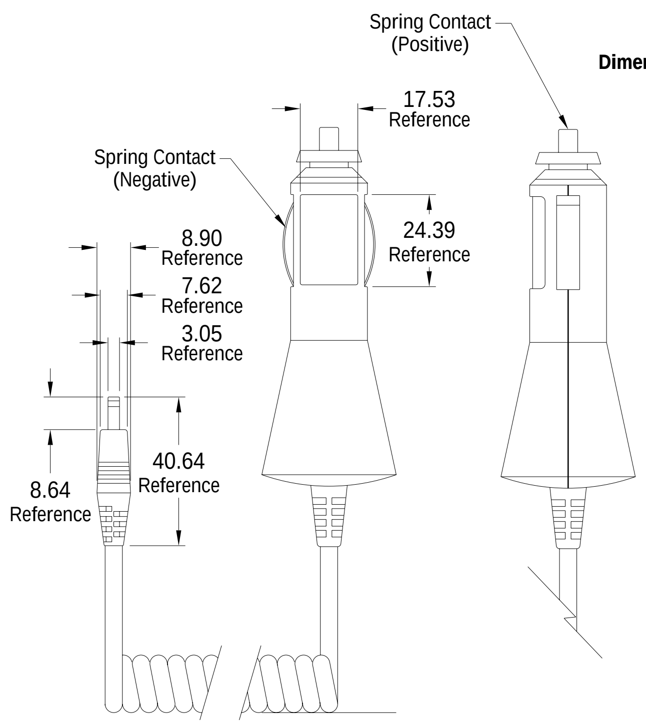
Engineering Data

ENERGIZER MODEL NO. CS7348

Charger Saver

Designation: Charger Saver for Cellular Phone System For Nokia 636
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 6.5 VDC @ 850 mA
Typical Cord Length: 610 mm (24 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: 122.3 grams (4.3 oz.)
Feature: Black Cigar Lighter Plug



Dimensions (mm)

Millimeters	Inches
3.05	.120
7.62	.300
8.64	.340
8.90	.350
17.53	.690
24.39	.960
40.64	1.600

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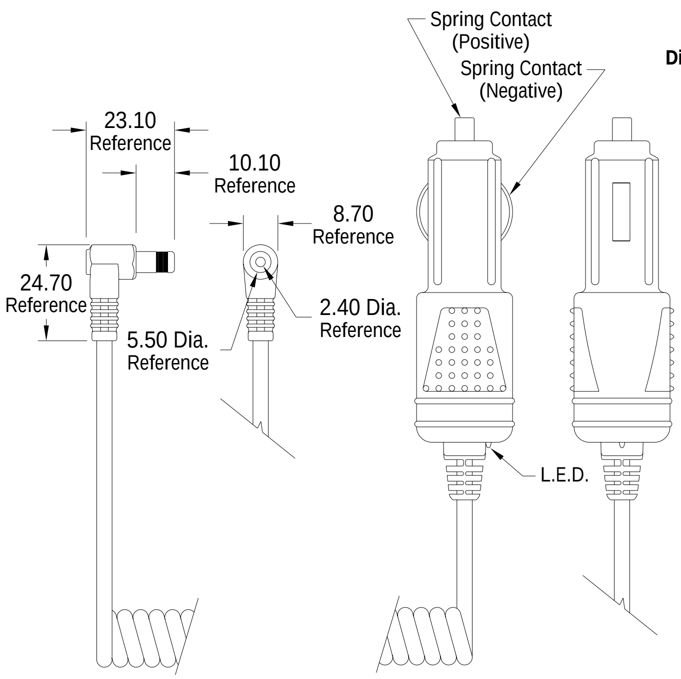
Engineering Data

ENERGIZER MODEL NO. CS7548

Charger Saver

Designation: Charger Saver for Cellular Phone System
For Mitsubishi AH-129 Series
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 6.5 VDC @ 850 mA
Typical Cord Length: 610 mm (24 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: 85.2 grams (3.0 oz.)
Feature: Black Cigar Lighter Plug



Dimensions (mm)

Millimeters	Inches
2.40	.095
5.50	.217
8.70	.343
10.10	.398
23.10	.910
24.70	.972

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Engineering Data

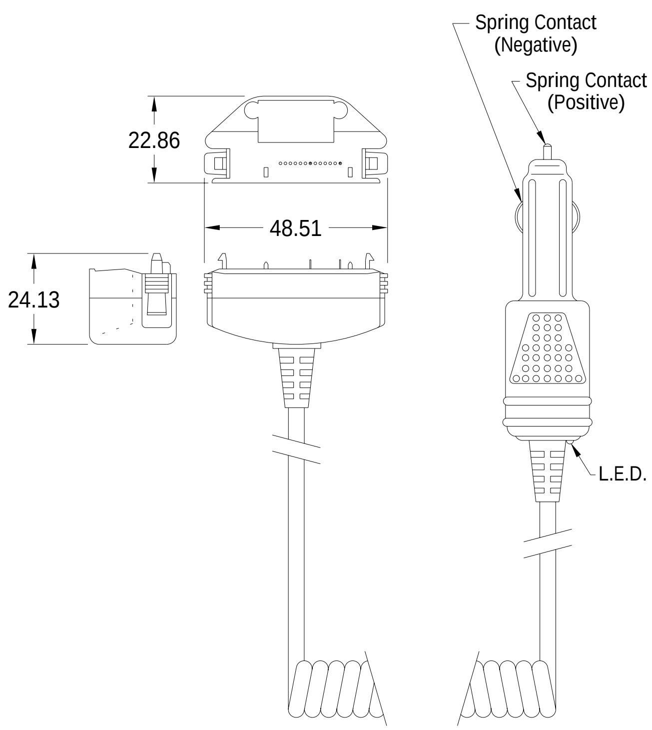
ENERGIZER MODEL NO. CS7661

Charger Saver

Designation: Charger Saver for Cellular Phone System
For GE CT-700, Ericsson AH237
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 6.5 VDC
Typical Cord Length: 2743 mm (108 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: 102.4 grams (3.6 oz.)
Feature: Black Cigar Lighter Plug

Dimensions (mm)

Millimeters	Inches
22.86	.900
24.13	.950
48.51	1.910



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Internet: www.energizer.com

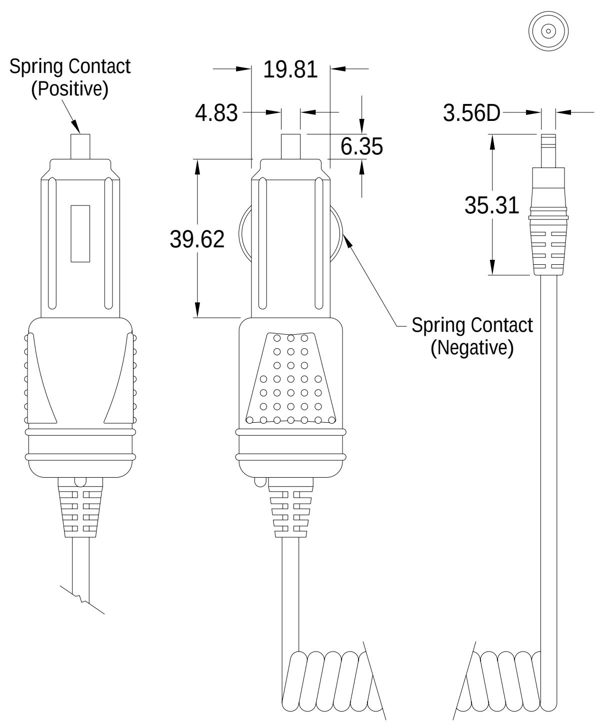
Engineering Data

ENERGIZER MODEL NO. CS8136

Charger Saver

Designation: Charger Saver for Cellular Phone System
For NOKIA 252/6100 series
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 8.58 VDC @ 700 mA
Typical Cord Length: 610 mm (24 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: 88 grams (3.1 oz.)
Feature: Variable Cigar Lighter Plug

Dimensions (mm)



Millimeters	Inches
3.56	.140
4.83	.190
6.35	.250
19.81	.780
35.31	1.390
39.62	1.560

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Telephone: 1-800-383-7323
Internet: www.energizer.com

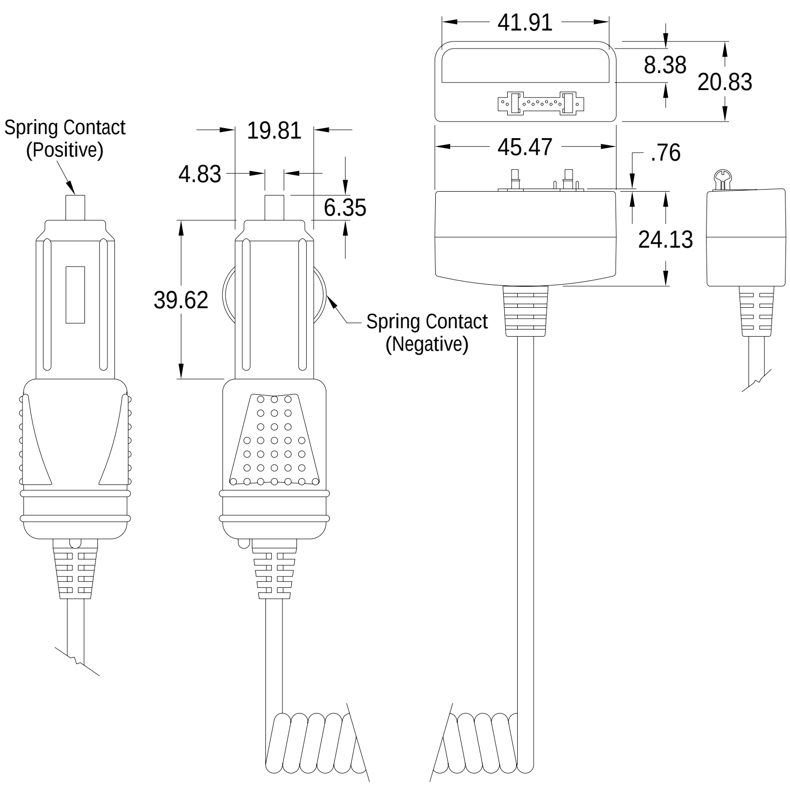
Engineering Data

ENERGIZER MODEL NO. CS8648

Charger Saver

Designation: Charger Saver for Cellular Phone System For ERICSSON 600/700 series
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 8.0 VDC @ 600 mA
Typical Cord Length: 610 mm (24 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: - grams (- oz.)
Feature: Variable Cigar Lighter Plug

Dimensions (mm)



Millimeters	Inches
.76	.030
4.83	.190
6.35	.250
8.38	.330
19.81	.780
20.83	.820
24.13	.950
39.62	1.560
41.91	1.650
45.47	1.790

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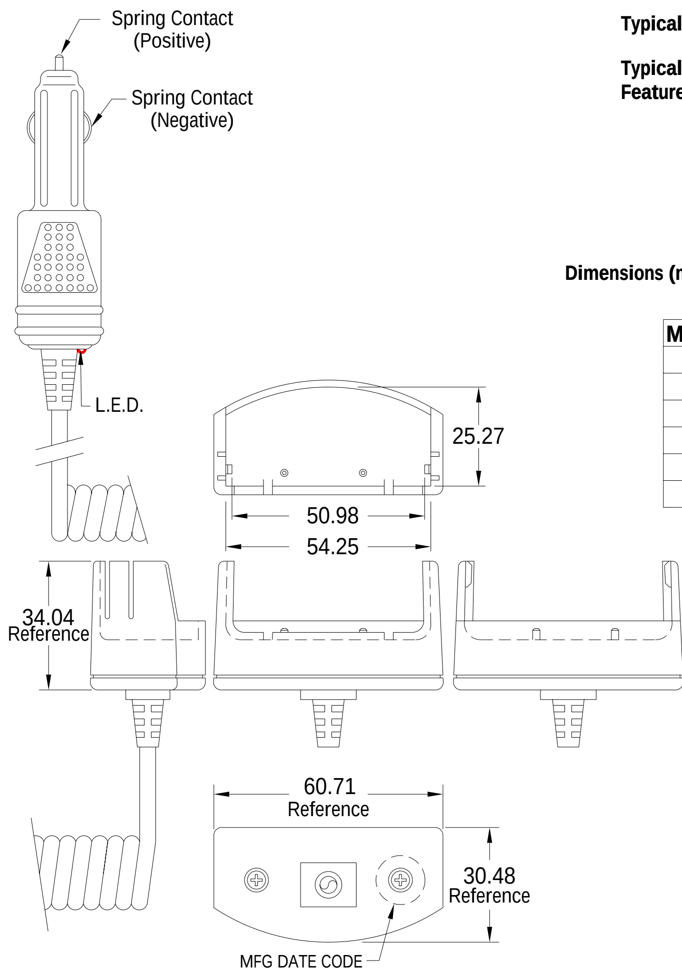
Engineering Data

ENERGIZER MODEL NO. CS9061

Charger Saver

Designation: Charger Saver for Cellular Phone System For OKI 1150
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 6.0 VDC @ 500 mA
Typical Cord Length: 2743 mm (108 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: 115 grams (4.1 oz.)
Feature: Black Cigar Lighter Plug



Dimensions (mm)

Millimeters	Inches
25.27	.995
30.48	1.200
34.04	1.340
50.98	2.007
54.25	2.136
60.71	2.390

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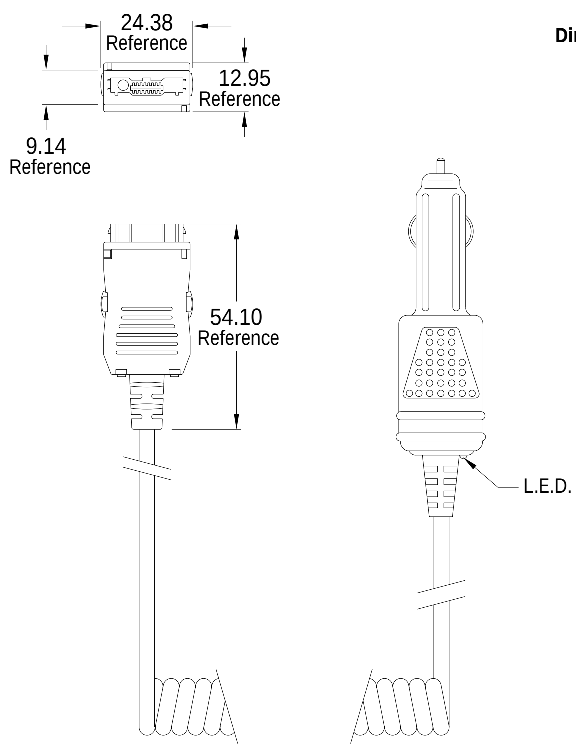
Engineering Data

ENERGIZER MODEL NO. CS9148

Charger Saver

Designation: Charger Saver for Cellular Phone System
For -
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: - VDC @ - mA
Typical Cord Length: - mm (- inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: 91.5 grams (3.2 oz.)
Feature: Black Cigar Lighter Plug



Dimensions (mm)

Millimeters	Inches
9.14	.360
12.95	.510
24.38	.960
54.10	2.130

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Internet: www.energizer.com

Engineering Data

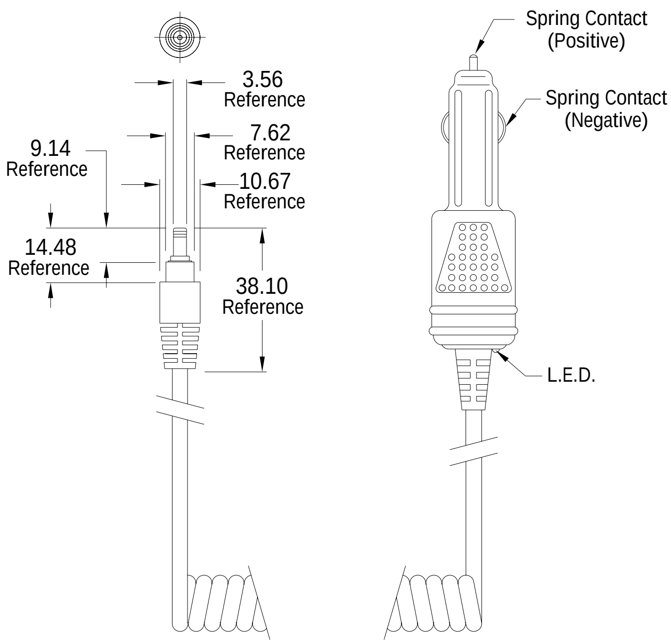
ENERGIZER MODEL NO. CS9161

Charger Saver

Designation: Charger Saver for Cellular Phone System For OKI 1335
Voltage Specification: Input Voltage: 10 - 18 VDC
Output Voltage: 6.5 VDC @ 850 mA
Typical Cord Length: 2743 mm (108 inch) minimum when stretched briefly with 2.3 kg (5 lbs) maximum force @ 20°C-25°C
Typical Weight: 89.4 grams (3.2 oz.)
Feature: Black Cigar Lighter Plug

Dimensions (mm)

Millimeters	Inches
3.56	.140
7.62	.300
9.14	.360
10.67	.420
14.48	.570
38.10	1.500



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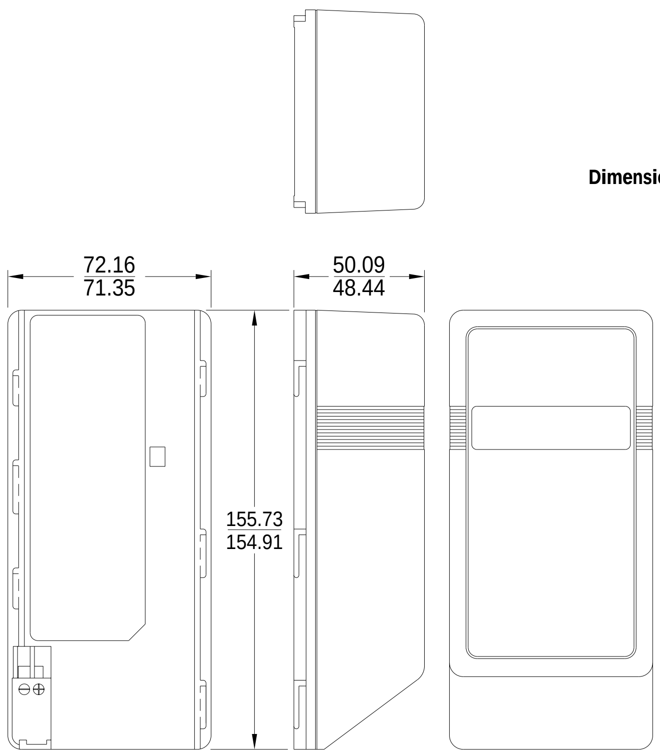
Engineering Data

ENERGIZER NO. CV2012

Designation: NiCd Camcorder Battery
For -

Nominal Voltage: 12 VDC
Typical Capacity: 1800 mAh
Typical Weight: 595.5 grams (21.1 oz.)



Dimensions (mm)

Millimeters	Inches
48.44	1.907
50.09	1.972
71.35	7.170
72.16	2.841
154.91	6.099
155.73	6.131

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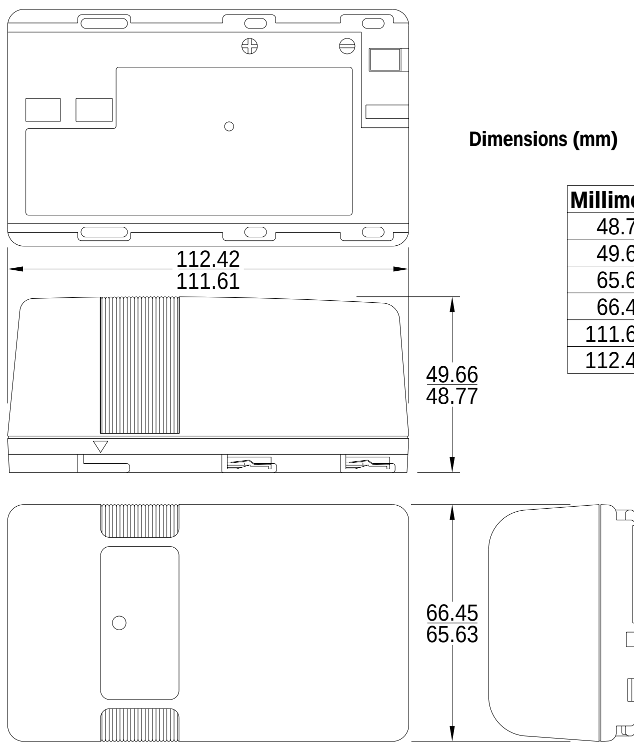
Engineering Data

ENERGIZER NO. CV2096

Designation: NiCd Camcorder Battery
For -

Nominal Voltage: 9.6 VDC
Typical Capacity: 1800 mAh
Typical Weight: 459.9 grams (16.3 oz.)



Dimensions (mm)

Millimeters	Inches
48.77	1.920
49.66	1.955
65.63	2.584
66.45	2.616
111.61	4.394
112.42	4.426

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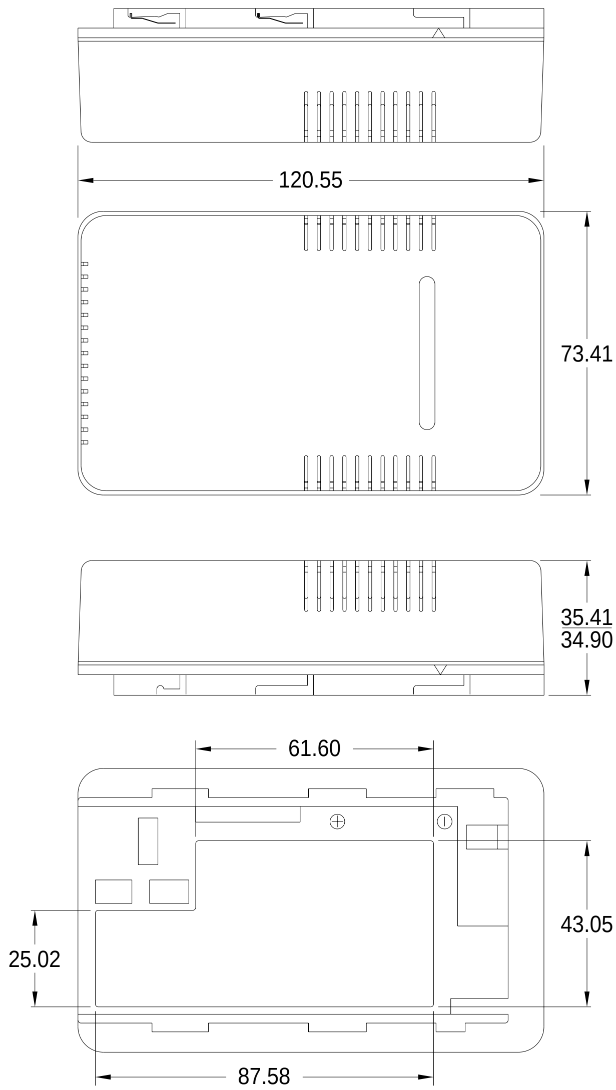
Engineering Data

ENERGIZER NO. CV3010S

Designation: Lead Acid VHS Camcorder Battery
For Hitachi, RCA

Nominal Voltage: 10 VDC
Typical Capacity: 2000 mAh
Typical Weight: 567 grams (20.07 oz.)



Dimensions (mm)

Millimeters	Inches
25.02	.985
34.90	1.374
35.41	1.394
43.05	1.695
61.60	2.425
73.41	2.890
87.58	3.448
120.55	4.746

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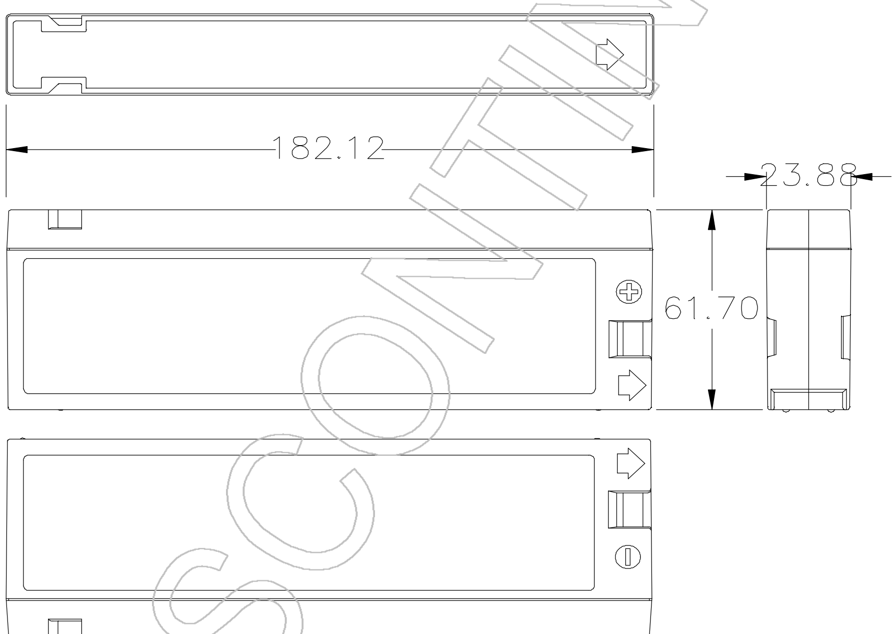
Engineering Data

ENERGIZER NO. CV3012

Dimensions (MM)

Designation: Lead Acid VHS Camcorder Battery
For Panasonic, GE, and Magnavox
Nominal Voltage: 12VDC
Typical Capacity: 2300 mAh
Typical Weight: 681.8 grams (24.1 oz.)

Millimeters	Inches
23.88	0.940
61.70	2.429
182.12	7.170



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Energizer

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Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CV3060

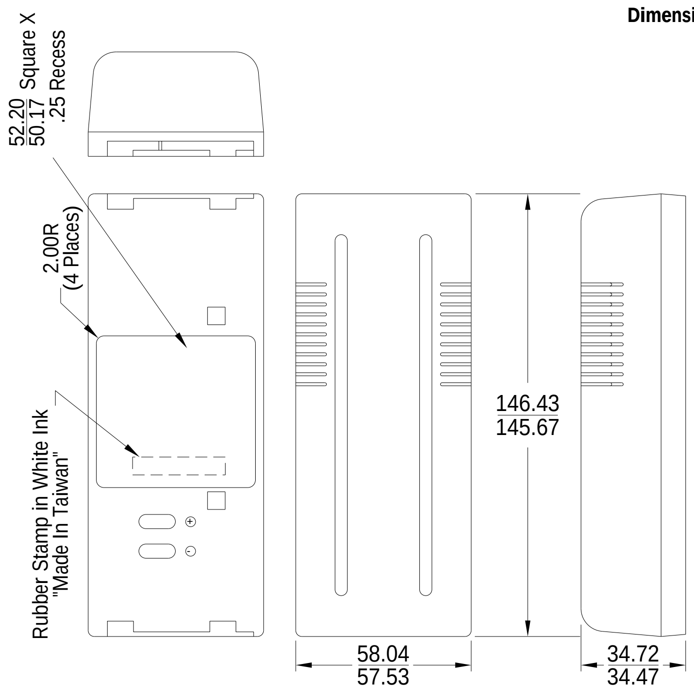
Designation: Lead Acid Camcorder Battery
For Sharp Slim-Cam

Nominal Voltage: 6 VDC

Typical Capacity: 3500 mAh

Typical Weight: 387.3 grams (13.7 oz.)

Dimensions (mm)



Millimeters	Inches
.25	.010
2.00	.079
34.47	1.357
34.72	1.367
50.17	1.975
52.20	2.055
57.53	2.265
58.04	2.285
145.67	5.735
146.43	5.765

IMPORTANT NOTICE

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

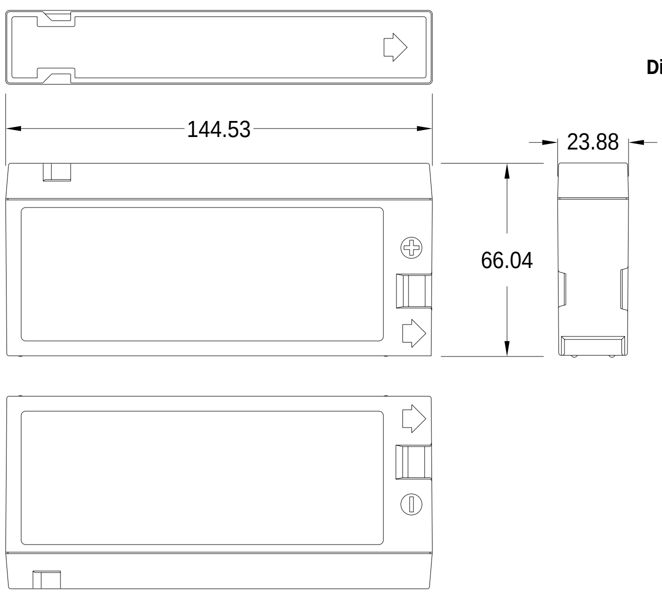
ENERGIZER NO. CV3112

Designation: Lead Acid VHS Camcorder Battery
For Panasonic, GE and Magnavox

Nominal Voltage: 12 VDC

Typical Capacity: 2000 mAh

Typical Weight: 500 grams (17.7 oz.)



Dimensions (mm)

Millimeters	Inches
23.88	.940
61.70	2.429
182.12	7.170

Millimeters	Inches
23.88	.940
62.99	2.480
66.04	2.600
141.99	5.590
144.53	5.690

IMPORTANT NOTICE

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St. Louis, MO 63164
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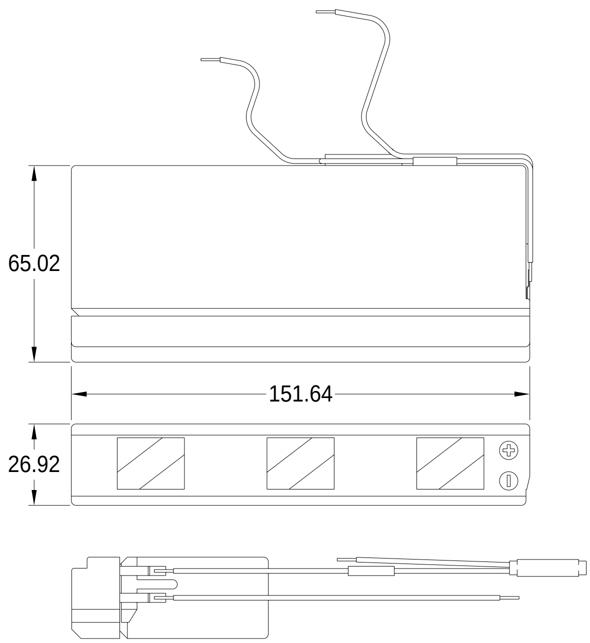
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CV3212

Designation: Lead Acid VHS Camcorder Battery
For Panasonic, GE and Magnavox

Nominal Voltage: 12 VDC
Typical Capacity: 2000 mAh
Typical Weight: 818.2 grams (29.0 oz.)



Dimensions (mm)

Millimeters	Inches
26.92	1.060
65.02	2.560
151.64	5.970

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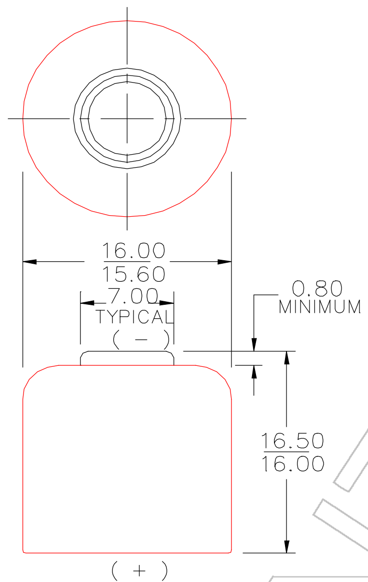
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. E1



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1100M, IEC-NR50
Typical Capacity (to 0.9V): 1,000 mAh
(Rated capacity at 62 ohms @ 21°C)
Typical Weight: 13.5 grams (0.48 oz.)
Volume: 3.3 cubic centimeters (0.2 cubic in.)
Cells: 1-P
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.80	0.031
7.00	0.276
15.60	0.614
16.00	0.630
16.50	0.650

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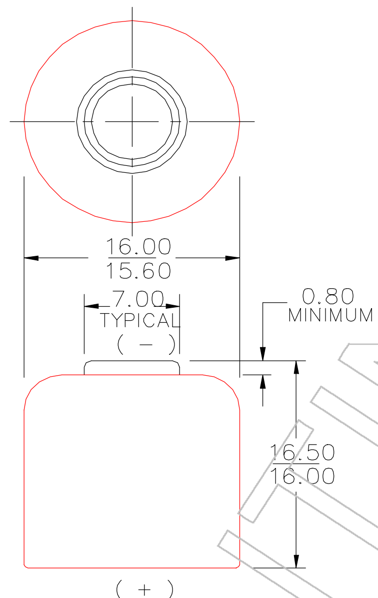
Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. E1N



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1109M, IEC-MR50
Typical Capacity (to 0.9V): 1,000 mAh
(Rated capacity at 62 ohms @ 21°C)
Typical Weight: 14.3 grams (0.5 oz.)
Volume: 3.3 cubic centimeters (0.2 cubic in.)
Cells: 1N-P
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.80	0.031
7.00	0.276
15.60	0.614
16.00	0.630
16.50	0.650

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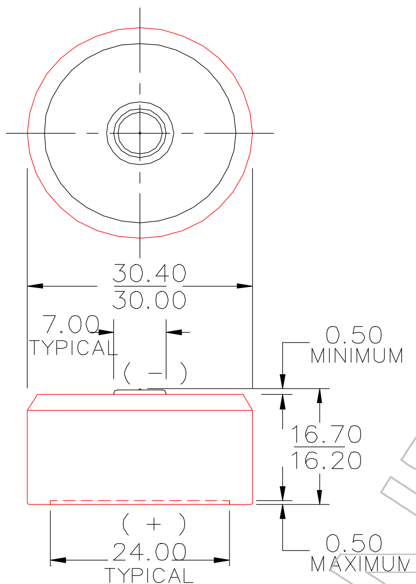
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. E4



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1112M, IEC-MR19
Typical Capacity (to 0.9V): 3,000 mAh
(Rated capacity at 62 ohms @ 21^{o}C)
Typical Weight: 41 grams (1.45 oz.)
Volume: 12.1 cubic centimeters (0.74 cubic in.)
Cells: 4-P
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.50	0.020
7.00	0.276
16.20	0.638
16.70	0.657
24.00	0.945
30.00	1.181
30.40	1.197

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Eveready Battery Company, Inc.

533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

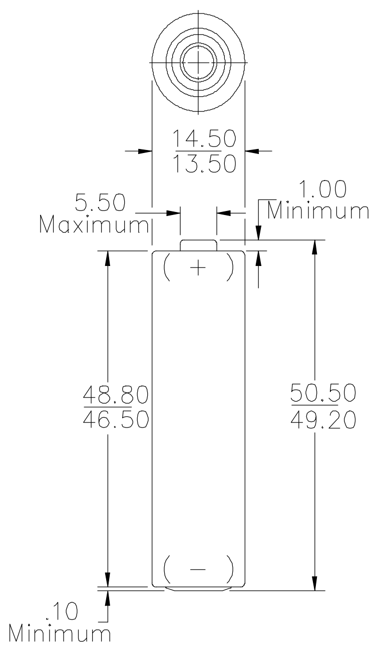
Engineering Data

AA
Alkaline **1.5V**
No Added Mercury or Cadmium

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

ENERGIZER NO. E91

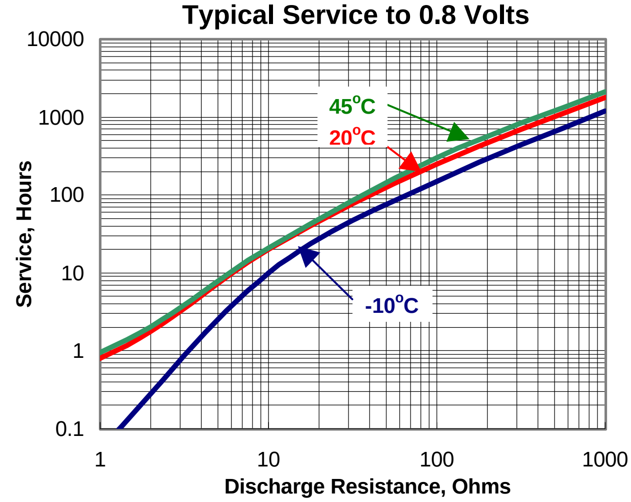
Dimensions (mm)



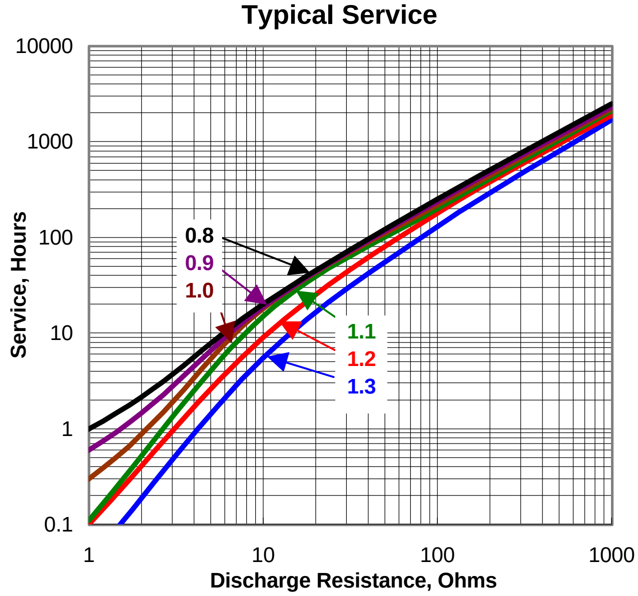
Millimeters	Inches
0.1	0.004
1.0	0.039
5.5	0.217
13.5	0.531
14.5	0.571
46.5	1.831
48.8	1.921
49.2	1.937
50.5	1.988

Designation: ANSI-15A, IEC-LR6
Battery Voltage: 1.5 Volts
Average Weight: 23 grams (0.8oz.)
Volume: 8.1 cubic centimeters (0.5cubic inch)
Average Service capacity (to 0.8Volts / cell): 2850 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 3-315 (size “AA”)
Jacket: Plastic Label
Shelf Life: 7 years

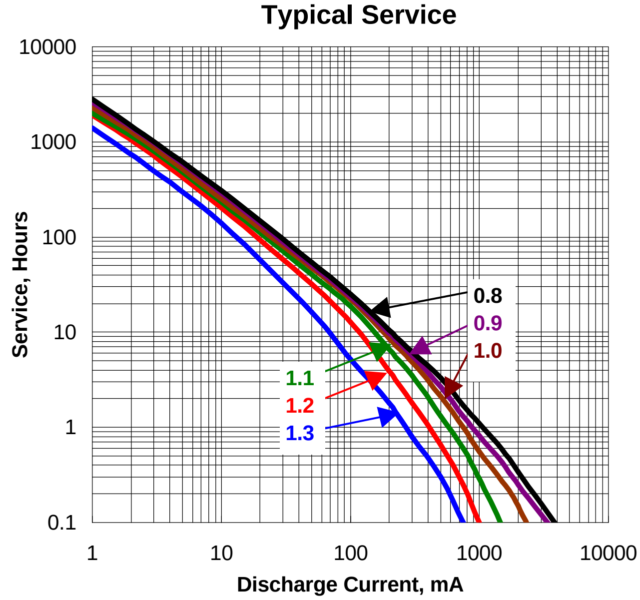
Temperature Effects
Typical Service to 0.8 Volts



Constant Resistance Discharge
Typical Service

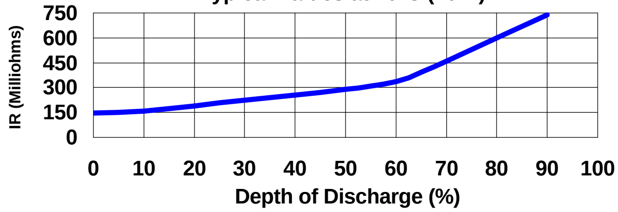


Constant Current Discharge
Typical Service



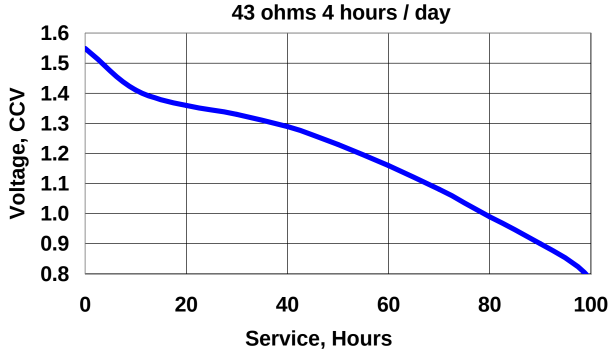
ENERGIZER NO. E91

Internal Resistance
Typical Values at 20°C (70°F)

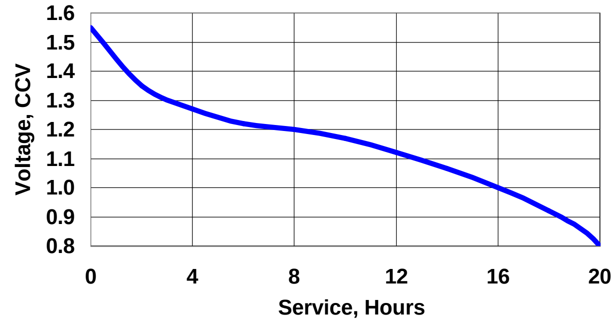


Typical Applications

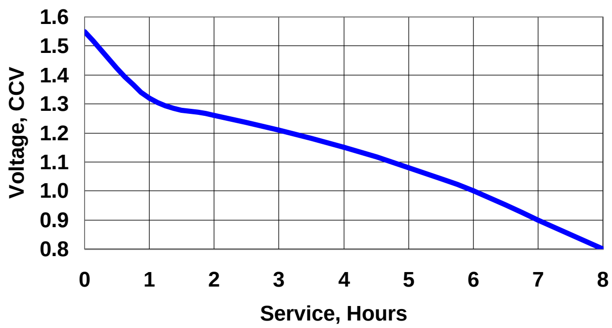
Radio
43 ohms 4 hours / day



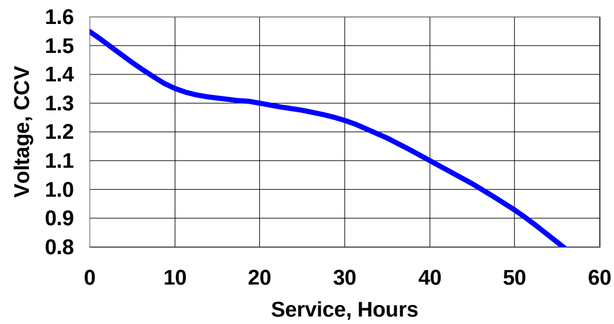
Recorder
10 ohms 1 hour / day



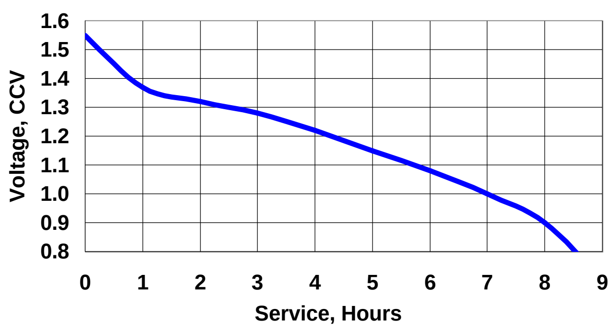
Toy
3.9 ohms 1 hour / day



Remote
24 ohms 15 sec / min - 8 hrs / day

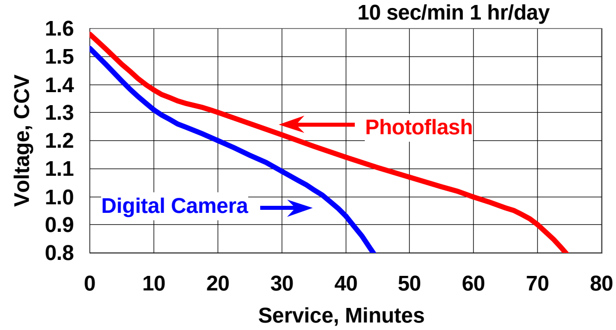


CD / MD / Electronic Game
250 mA 1 hour / day



Digital Camera
1000 mA Cont.

Photo Flash
1000 mA
10 sec/min 1 hr/day



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Eveready Battery Company, Inc.

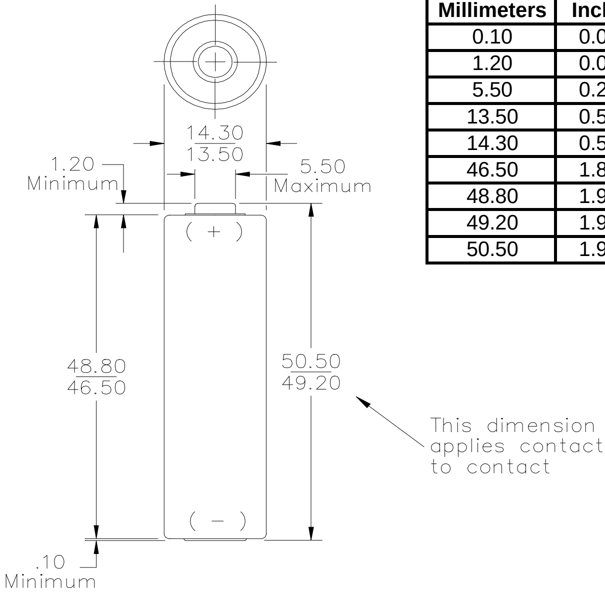
Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

AA
LITHIUM
ENERGIZER

ENERGIZER e² NO. L91

Dimensions (mm)

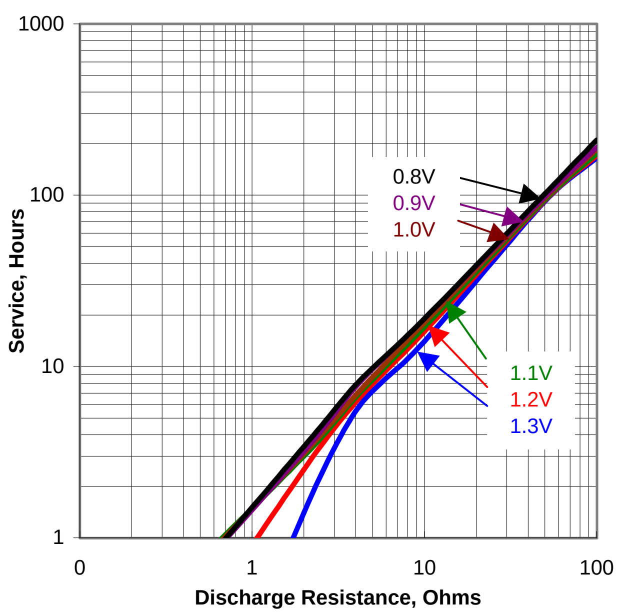


Millimeters	Inches
0.10	0.004
1.20	0.047
5.50	0.217
13.50	0.531
14.30	0.563
46.50	1.831
48.80	1.921
49.20	1.937
50.50	1.988

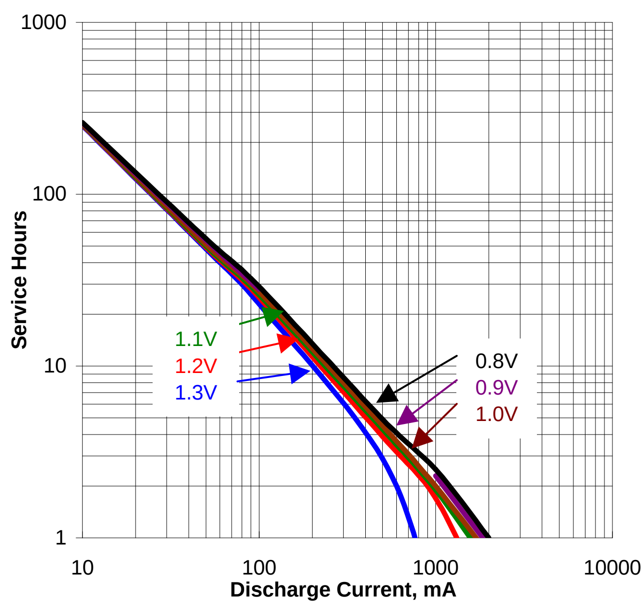
Chemical System: Lithium/Iron Disulfide (Li/FeS_2)

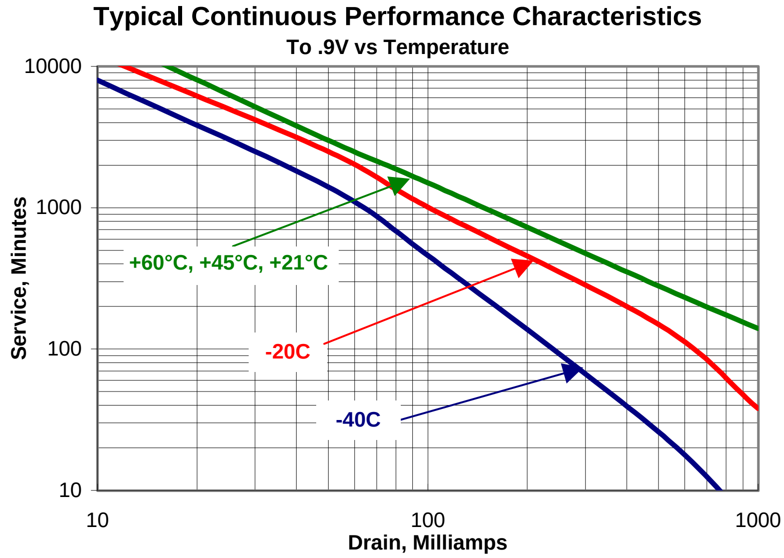
Designation: ANSI / NEDA - 15LF
Battery Voltage: 1.5 Volts
Average Weight: 14.5 grams (0.51oz.)
Volume: 8 cubic centimeters (0.49 cubic inch)
Storage Temperature Range:
-40°C to +60°C (-40°F to +140°F)
Operating Temperature Range:
-40°C to +60°C (-40°F to +140°F)
Maximum Discharge: 1.4A Continuous
Lithium Content: Less than 1 gram (0.04 oz.) per cell
Jacket: Non-magnetic plastic label
Transportation: Meets requirements of 49CFR 173.185 (b) and IATA Special Provisions A45
Shelf Life: 10 years (+)

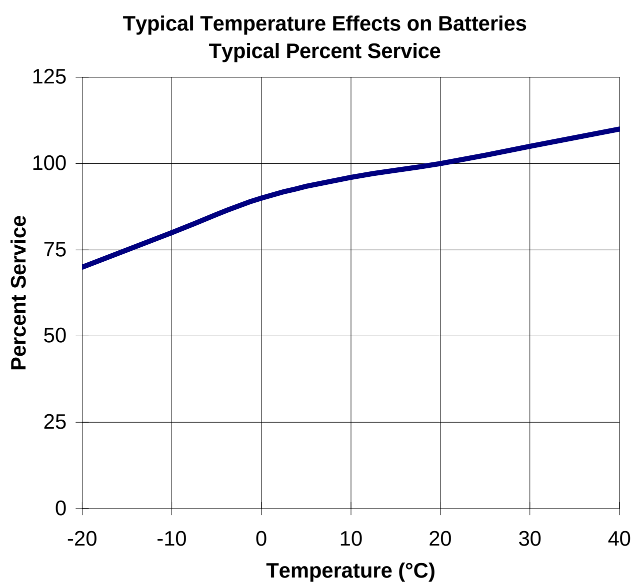
CONSTANT RESISTANCE PERFORMANCE
Typical Service

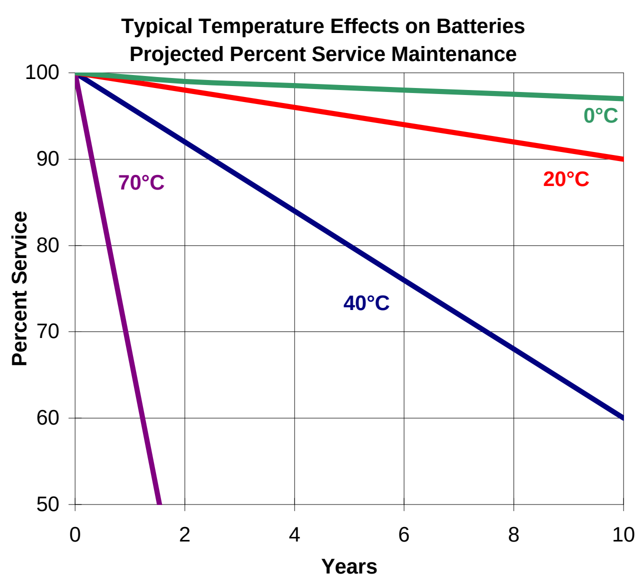


CONSTANT CURRENT PERFORMANCE
Typical Service









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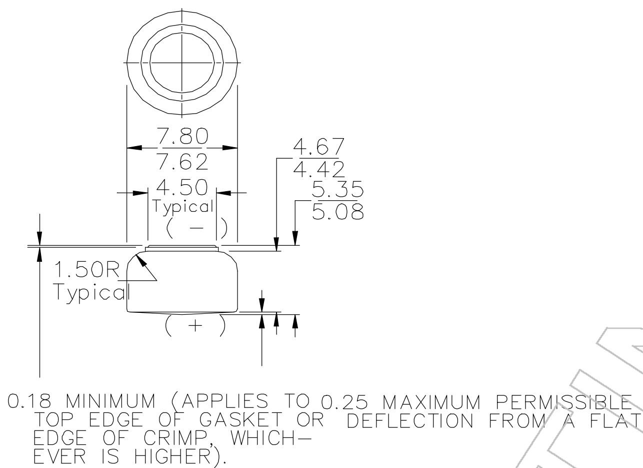
Energizer

Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. E13E



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1180M, IEC-NR48
Average Service Capacity (to 0.9 volts): 100 mAh
(Rated Capacity at 1.5K ohms @ 21^{o}C)
Typical Weight: 1.1 grams (0.04 oz.)
Volume: 0.3 cubic centimeters (0.02 cubic in.)

Dimensions (mm)

Millimeters	Inches
0.13	0.005
0.25	0.010
1.50	0.059
4.42	0.174
4.50	0.177
4.67	0.184
5.08	0.200
5.35	0.211
7.62	0.300
7.80	0.307

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Eveready Battery Company, Inc.
Checkerboard Square
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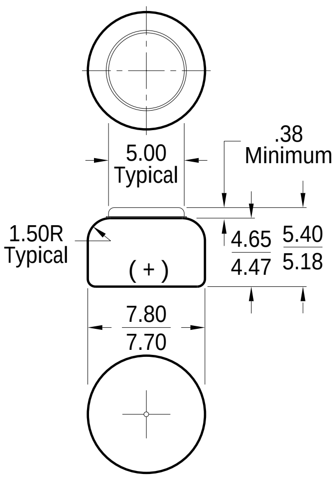
Engineering Data

ENERGIZER NO. AC13

Dimensions (mm)

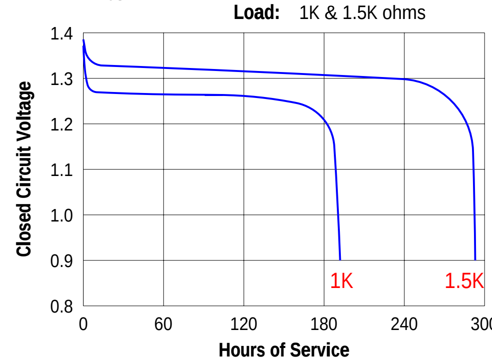


Millimeters	Inches
.38	.015
1.50	.059
4.47	.176
4.65	.183
5.00	.197
5.18	.204
5.40	.213
7.70	.303
7.80	.307

Chemical System: Zinc Air (ZnO_2)

Designation: IEC-PR48
Battery Voltage: 1.4 Volts
Average Weight: 0.8 grams (0.03 oz.)
Volume: 0.3 cubic centimeters (0.02 cubic inch)
Average Service Capacity (to 0.9 Volt): 255 mAh
(Rated capacity at 1.5K ohms at 21°C and 50%RH)
Cells: AC13

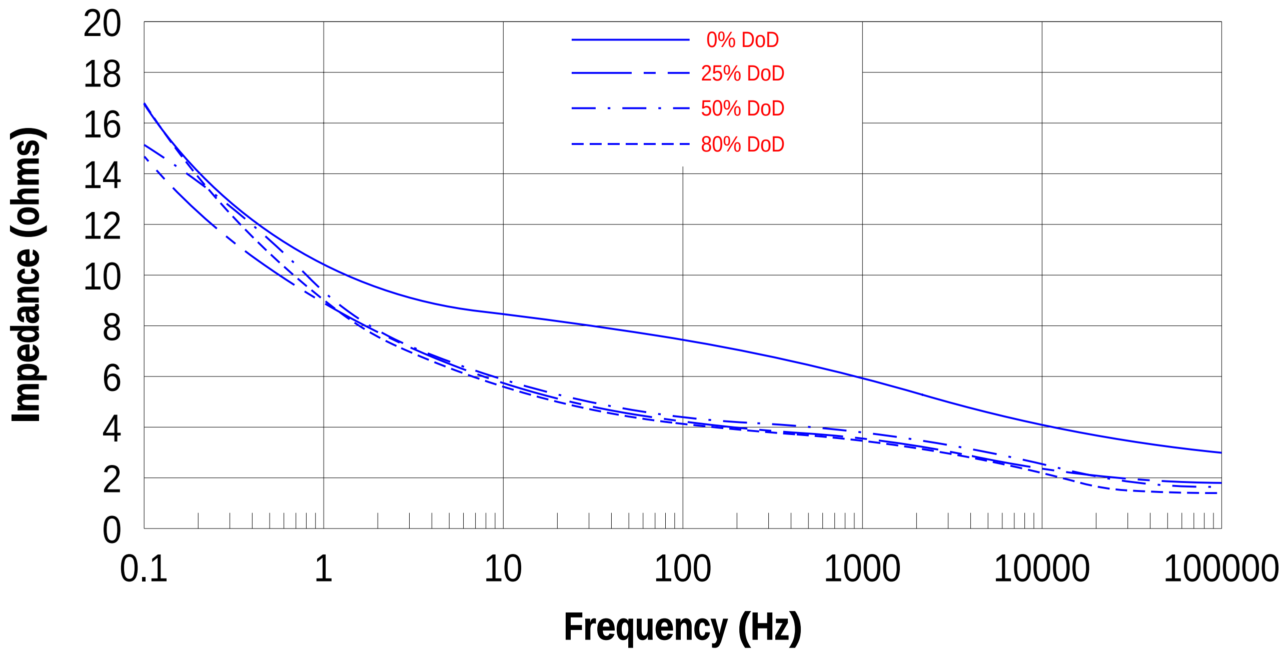
TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 16 hours/day
Typical Drain @ 1.3V: 1.3 & .87 milliamperes
Load: 1K & 1.5K ohms



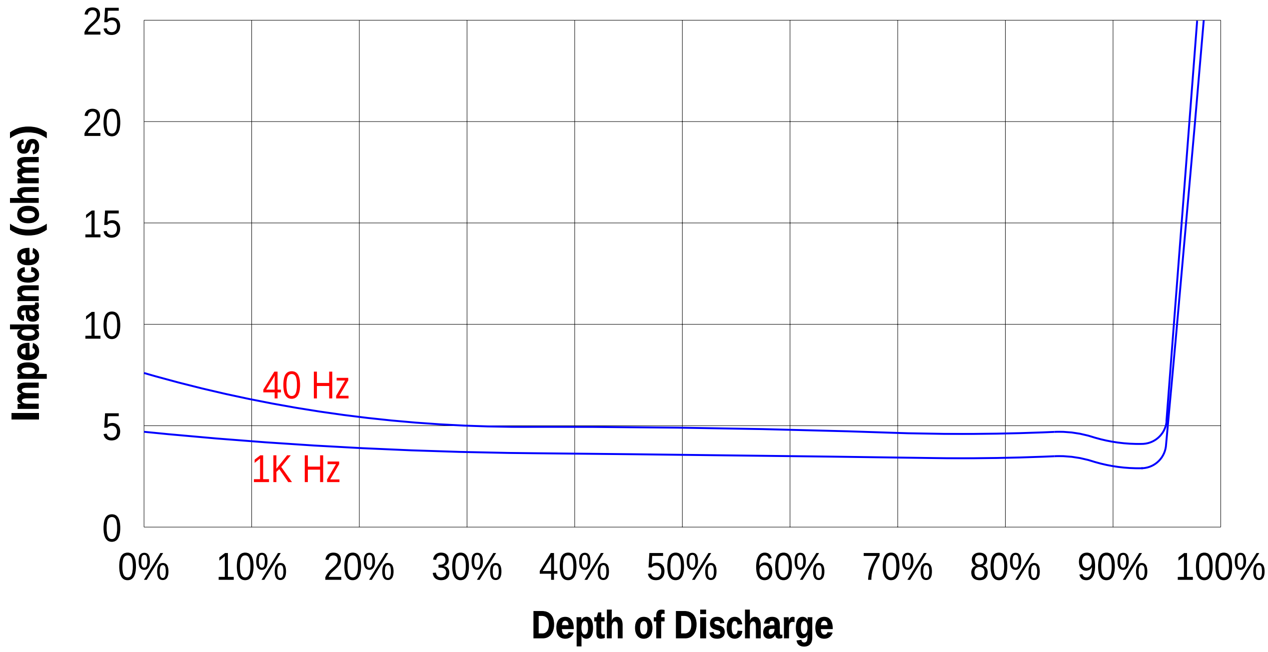
SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F) and 50% RH

Schedule	Typical Drains @ 1.3V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 0.9V hours
16 hours / day	1.3	1,000	196
16 hours / day	.87	1,500	293

Impedance vs. Frequency



Impedance vs. Depth of Discharge



IMPEDANCE (Z) : The total opposition that a battery offers to the flow of alternating current. Impedance is a combination of resistance and reactance.

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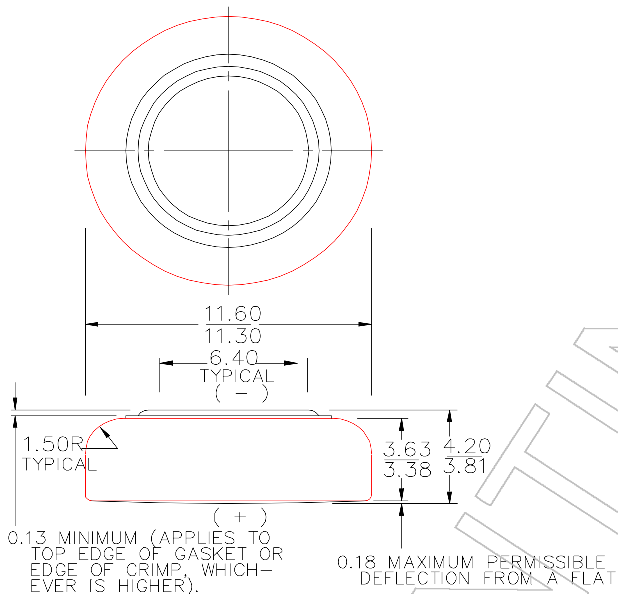
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. E41E



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1182M, IEC-NR43
Average Service Capacity (to 0.9 volts): 175 mAh
(Rated Capacity at 1,000 ohms @ 21^{o}C)
Typical Weight: 2.0 grams (0.07 oz.)
Volume: 0.3 cubic centimeters (0.02 cubic in.)
Terminals: Flat contact

Dimensions (mm)

Millimeters	Inches
0.13	0.005
0.18	0.007
1.50	0.059
3.38	0.133
3.63	0.143
3.81	0.150
4.20	0.165
6.40	0.252
11.30	0.445
11.60	0.457

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Eveready Battery Company, Inc.

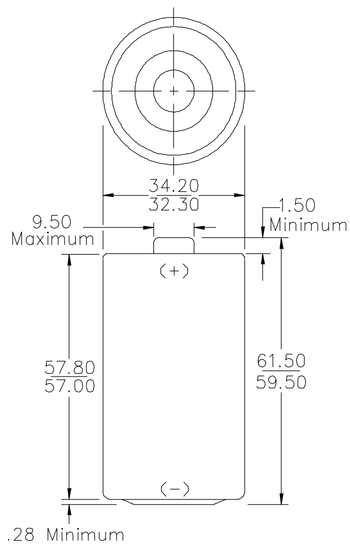
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

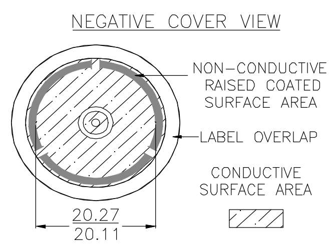
D
Alkaline **1.5V**
No Added Mercury or Cadmium

ENERGIZER NO. E95

Dimensions (mm)



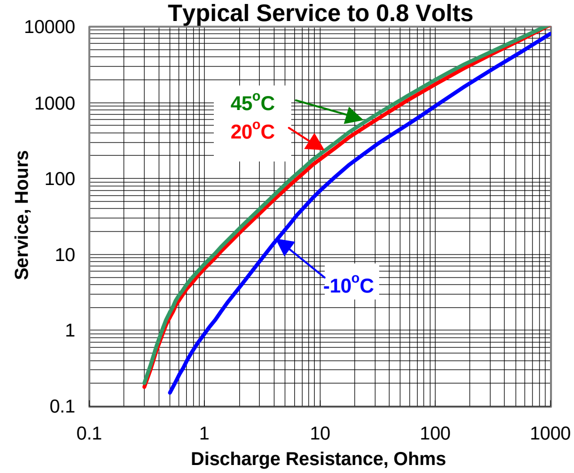
Millimeters	Inches
0.28	0.011
1.50	0.059
9.50	0.374
20.11	0.792
20.27	0.798
32.30	1.272
34.20	1.346
57.00	2.244
57.80	2.276
59.50	2.343
61.50	2.421



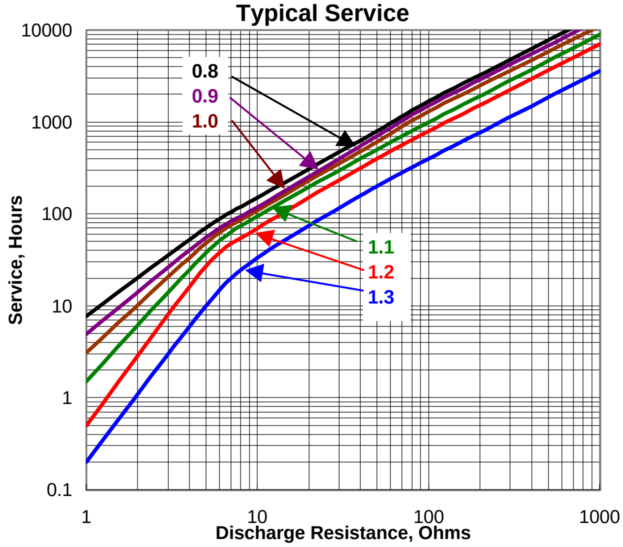
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-13A, IEC-LR20
Battery Voltage: 1.5 Volts
Average Weight: 141.9 grams (5.0 oz.)
Volume: 55.9 cubic centimeters (3.4 cubic inch)
Average Service capacity (to 0.8 Volts / cell): 18000 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 3-350 (size "D")
Jacket: Plastic Label
Shelf Life: 7 years

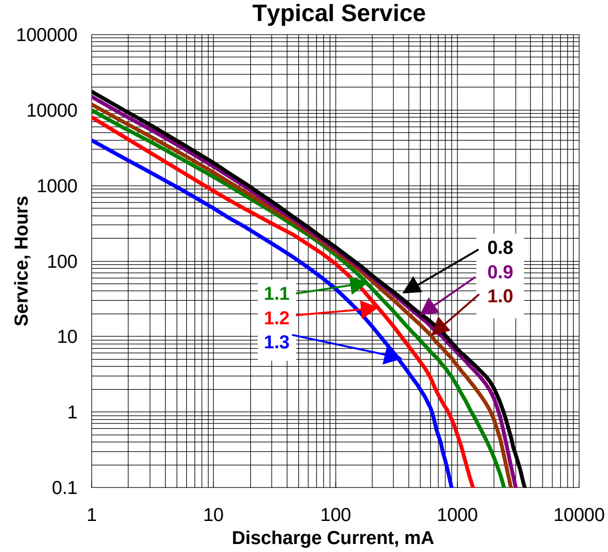
Temperature Effects
Typical Service to 0.8 Volts



Constant Resistance Discharge
Typical Service

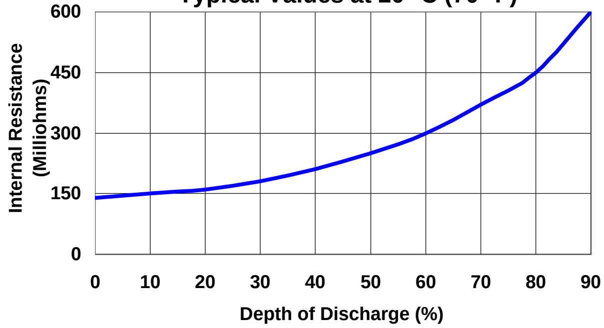


Constant Current Discharge
Typical Service



Internal Resistance

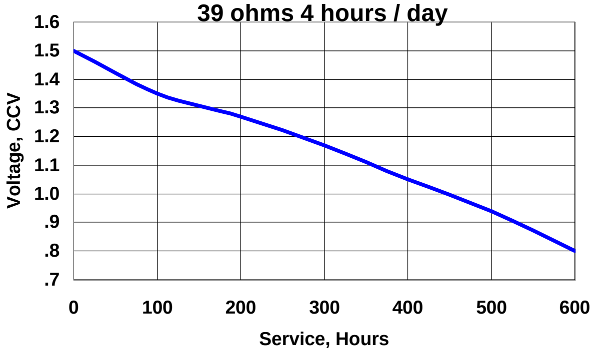
Typical Values at 20° C (70° F)



Typical Applications

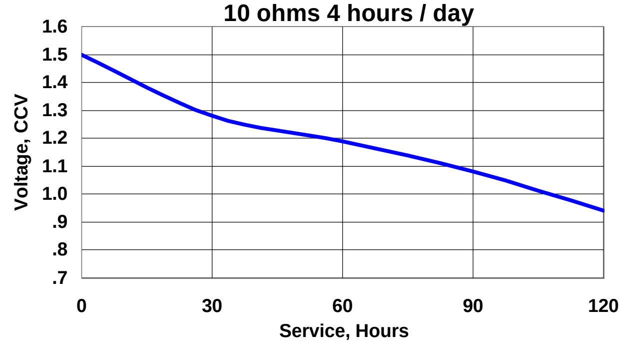
Radio

39 ohms 4 hours / day



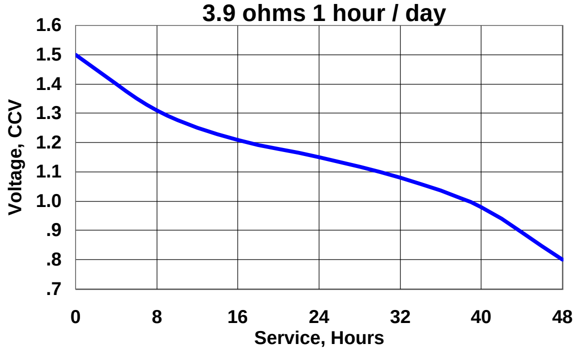
Recorder

10 ohms 4 hours / day



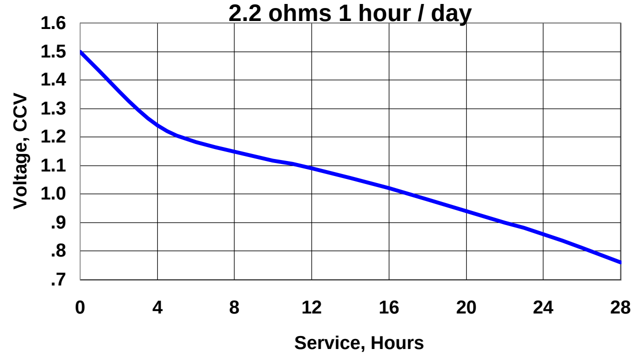
Recorder

3.9 ohms 1 hour / day



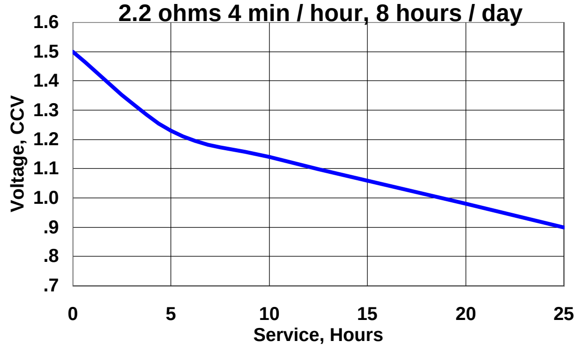
Toy

2.2 ohms 1 hour / day



Portable Lighting

2.2 ohms 4 min / hour, 8 hours / day



Important Notice

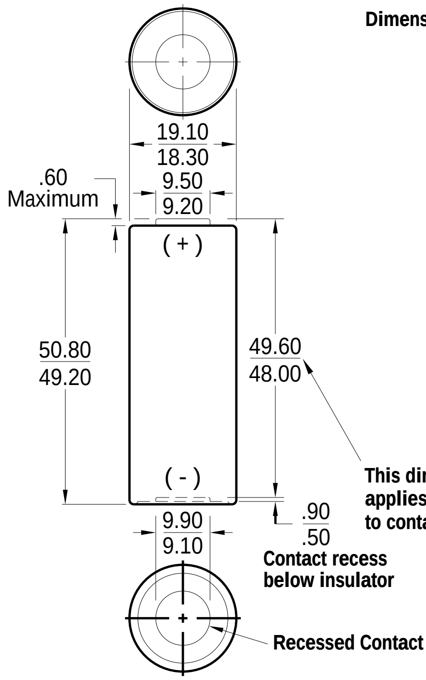
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

EVEREADY NO. 206

Zinc Chloride ***9V***
No Added Mercury or Cadmium

Dimensions (mm)

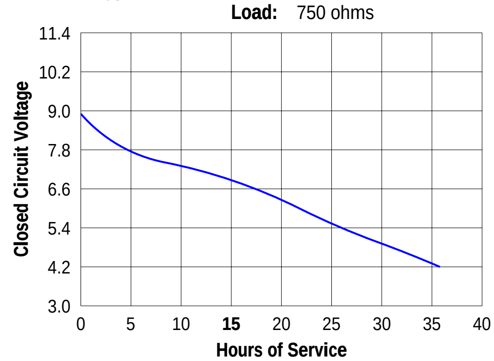


Millimeters	Inches
.50	.020
.60	.024
.90	.035
9.10	.358
9.20	.362
9.50	.374
9.90	.390
18.30	.720
19.10	.752
48.00	1.890
49.20	1.937
49.60	1.953
50.80	2.000

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-1611
Battery Voltage: 9 Volts
Average Weight: 32 grams (1.1 oz.)
Volume: 14 cubic centimeters (0.9 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 200 mAh
(Rated capacity at 25 mA continuous drain)
Cells: Six No. 110 in series
Jacket: Metal

TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 4 hours/day
Typical Drain @ 7.2V: 9.6 milliamperes
Load: 750 ohms



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 7.2V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 4.2V	4.8V	5.4V	6.0V	6.6V	7.2V	8.4V
			hours						
4 hours / day	9.6	750	35.8	31.0	26.0	21.8	17.4	11.4	1.7
4 hours / day	12.9	560	23.9	16.9	14.9	11.7	9.4	5.5	1.3

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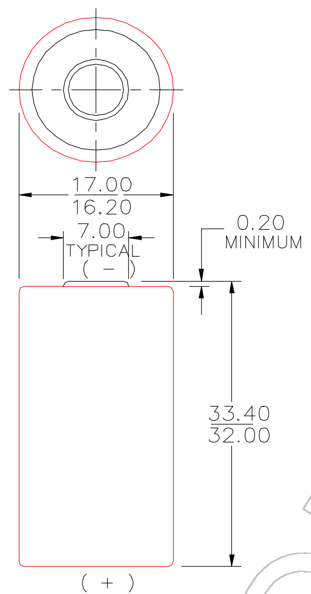
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. E132



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1200M, IEC-2NR50
Typical Capacity (to 1.8V): 1,000 mAh
(Rated capacity at 130 ohms @ 21°C)
Typical Weight: 28 grams (0.99 oz.)
Volume: 7.6 cubic centimeters (0.46 cubic in.)
Cells: Two 1-P in series
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.20	0.008
7.00	0.276
16.20	0.638
17.00	0.669
32.00	1.260
33.40	1.315

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Engineering Data

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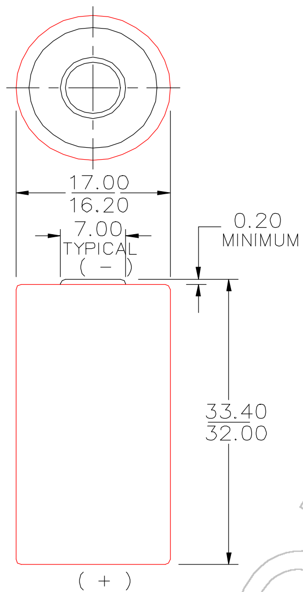

Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1203M, IEC-2MR50
Typical Capacity (to 1.8V): 1,000 mAh
(Rated capacity at 130 ohms @ 21°C)
Typical Weight: 30 grams (1.06 oz.)
Volume: 7.6 cubic centimeters (0.46 cubic in.)
Cells: Two 1N-P in series
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.20	0.008
7.00	0.276
16.20	0.638
17.00	0.669
32.00	1.260
33.40	1.315

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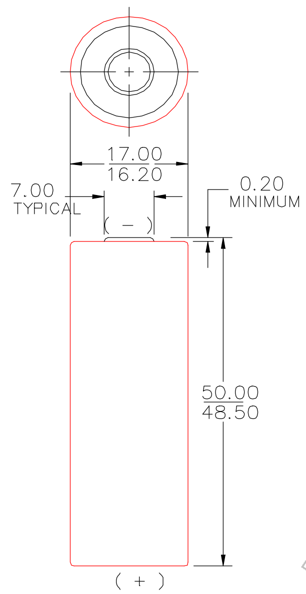
ENERGIZER NO. E133N



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1314M, IEC-3MR50
Average Service Capacity (to 2.7 volts): 1,000 mAh
(Rated Capacity at 180 ohms @ 21°C)
Typical Weight: 45 grams (1.59 oz.)
Volume: 11.3 cubic centimeters (0.69 cubic in.)
Cell: Three 1N-P in series

Dimensions (mm)

Millimeters	Inches
0.20	0.008
7.00	0.276
16.20	0.638
17.00	0.669
48.50	1.909
50.00	1.969

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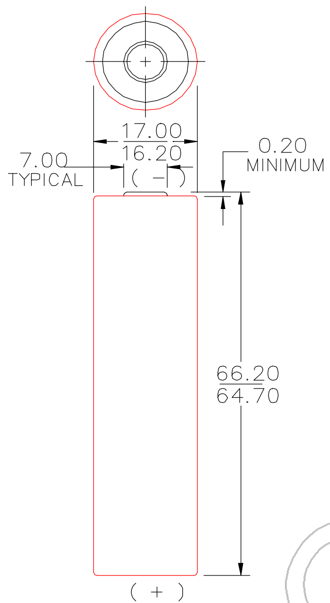
Engineering Data

ENERGIZER NO. E134



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1408M, IEC-4NR50
Typical Capacity (to 3.6V): 1,000 mAh
(Rated capacity at 270 ohms @ 21°C)
Typical Weight: 56 grams (1.98 oz.)
Volume: 15 cubic centimeters (0.92 cubic in.)
Cells: Four 1-P in series
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.20	0.008
7.00	0.276
16.20	0.638
17.00	0.669
64.70	2.547
66.20	2.606

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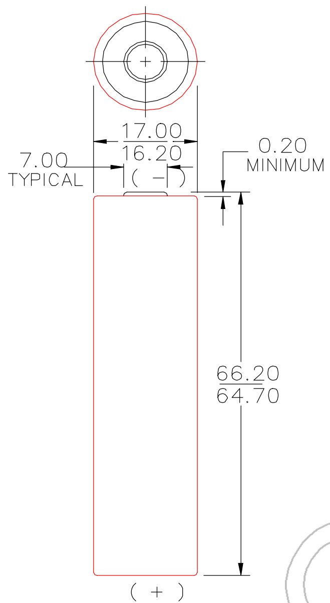
Engineering Data

ENERGIZER NO. E134N



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1409M, IEC-4MR50
Typical Capacity (to 3.6V): 1,000 mAh
(Rated capacity at 270 ohms @ 21^{o}C)
Typical Weight: 60 grams (2.12 oz.)
Volume: 15 cubic centimeters (0.92 cubic in.)
Cells: Four 1N-P in series
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.20	0.008
7.00	0.276
16.20	0.638
17.00	0.669
64.70	2.547
66.20	2.606

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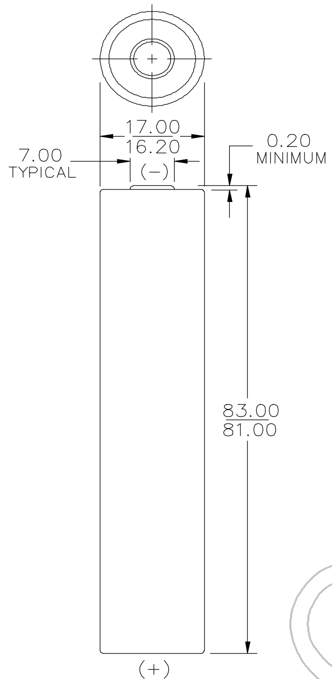
Engineering Data

ENERGIZER NO. E135N



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1505M, IEC-4MR50
Typical Capacity (to 4.5V): 1,000 mAh
(Rated capacity at 300 ohms @ 21°C)
Typical Weight: 74 grams (2.61 oz.)
Volume: 18.8 cubic centimeters (1.15 cubic in.)
Cells: Five 1N-P in series
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.20	0.008
7.00	0.276
16.20	0.638
17.00	0.669
81.00	3.189
83.00	3.268

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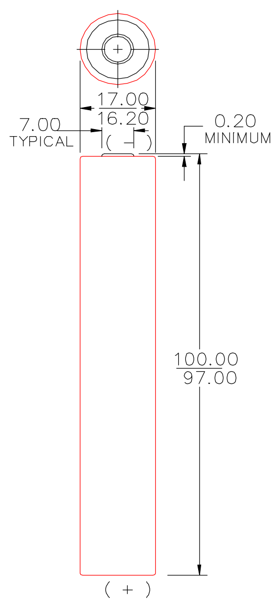
Engineering Data

ENERGIZER NO. E136



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1615M, IEC-6NR50
Typical Capacity (to 5.4V): 1,000 mAh
(Rated capacity at 390 ohms @ 21°C)
Typical Weight: 85 grams (3.0 oz.)
Volume: 22.7 cubic centimeters (1.39 cubic in.)
Cells: Six 1-P in series
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.20	0.008
7.00	0.276
16.20	0.638
17.00	0.669
97.00	3.819
100.00	3.937

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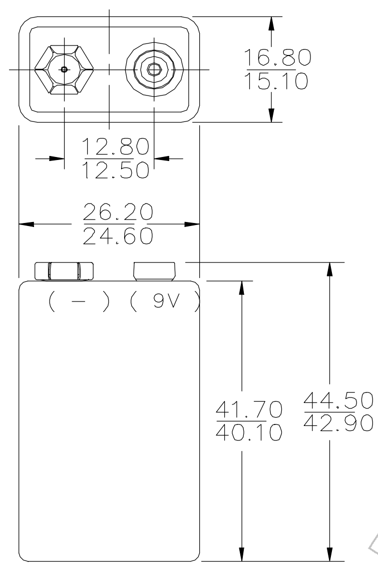
Engineering Data

ENERGIZER NO. E146X



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1604M
Average Service Capacity (to 5.4 volts): 580 mAh
(Rated Capacity at 750 ohms @ 21^{o}C)
Typical Weight: 55 grams (1.94 oz.)
Volume: 19.5 cubic centimeters (1.19 cubic in.)
Cell: Six No. 635-P in series
Terminals: Snap
Jacket: Metal

Dimensions (mm)

Millimeters	Inches
12.50	0.492
12.80	0.504
15.10	0.594
16.80	0.661
24.60	0.969
26.20	1.031
40.10	1.579
41.70	1.642
42.90	1.689
44.50	1.752

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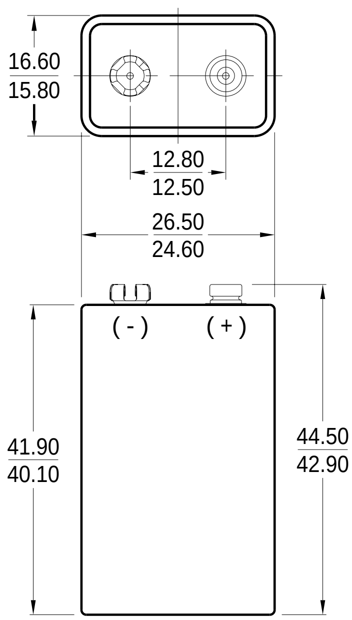
Engineering Data

ENERGIZER NO. AC146X



Plastic Jacket

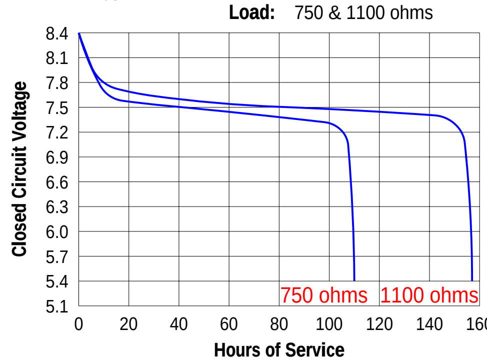
Dimensions (mm)

Millimeters	Inches
12.50	.492
12.80	.504
15.80	.622
16.60	.654
24.60	.969
26.50	1.043
40.10	1.579
41.90	1.650
42.90	1.689
44.50	1.752

Chemical System: Zinc Air (ZnO_2)

Designation: ANSI / NEDA-7004Z
Battery Voltage: 8.4 Volts
Average Weight: 33 grams (1.2 oz.)
Volume: 19.6 cubic centimeters (1.2 cubic inch)
Average Service Capacity (to 0.9 Volt / cell): 1.1 Ah
(Rated capacity at 1.1K ohms at 21°C and 50%RH)
Cells: Six No. 635 in series

TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 24 hours/day
Typical Drain @ 7.6V: 10 & 7 milliamperes
Load: 750 & 1100 ohms



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F) and 50% RH

Schedule	Typical Drains @ 7.6V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 5.4V hours
24 hours / day	10	750	110
24 hours / day	7	1,100	157

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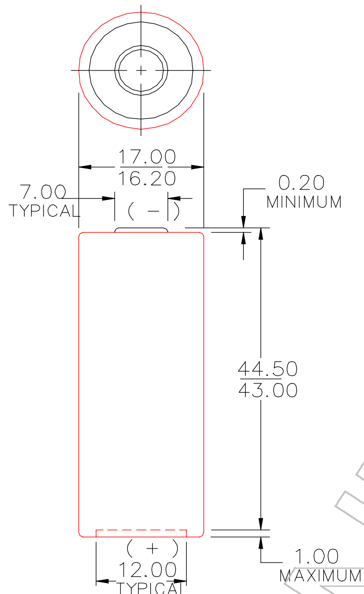
ENERGIZER NO. E164



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1404M, IEC-4NR52
Typical Capacity (to 3.6V): 500 mAh
(Rated capacity at 510 ohms @ 21^{o}C)
Typical Weight: 36 grams (1.27 oz.)
Volume: 10.2 cubic centimeters (0.62 cubic in.)
Cells: Four 640-P in series
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.20	0.008
1.00	0.039
7.00	0.276
12.00	0.472
16.20	0.638
17.00	0.669
43.00	1.693
44.50	1.752

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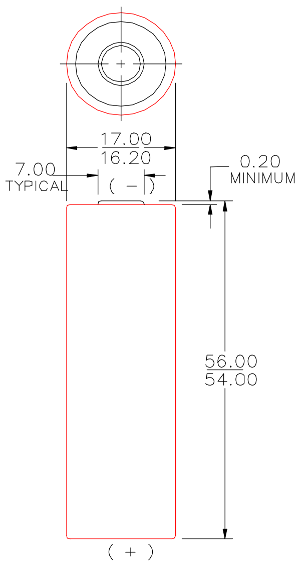
Engineering Data

ENERGIZER NO. E165



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1500M, IEC-5NR52
Typical Capacity (to 4.5V): 500 mAh
(Rated capacity at 680 ohms @ 21°C)
Typical Weight: 45 grams (1.59 oz.)
Volume: 12.7 cubic centimeters (0.78 cubic in.)
Cells: Five 640-P in series
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.20	0.008
1.00	0.039
7.00	0.276
16.20	0.638
17.00	0.669
54.00	2.126
56.00	2.205

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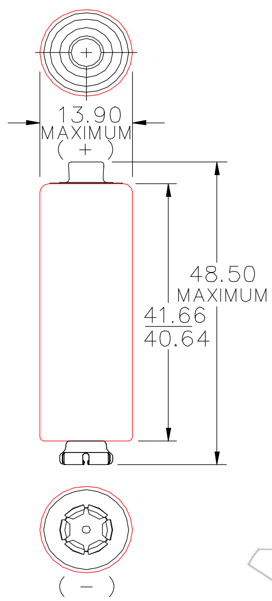
Engineering Data

ENERGIZER NO. E177



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1606M, IEC-7NR44
Average Service Capacity (to 6.3 volts): 230 mAh
(Rated Capacity at 4,500 ohms @ 21^{o}C)
Typical Weight: 24.1 grams (0.85 oz.)
Volume: 7.4 cubic centimeters (0.45 cubic in.)
Cell: Seven P675 in series
Terminals: ANSI Miniature Snap

Dimensions (mm)

Millimeters	Inches
13.90	0.547
40.64	1.600
41.66	1.640
48.50	1.910

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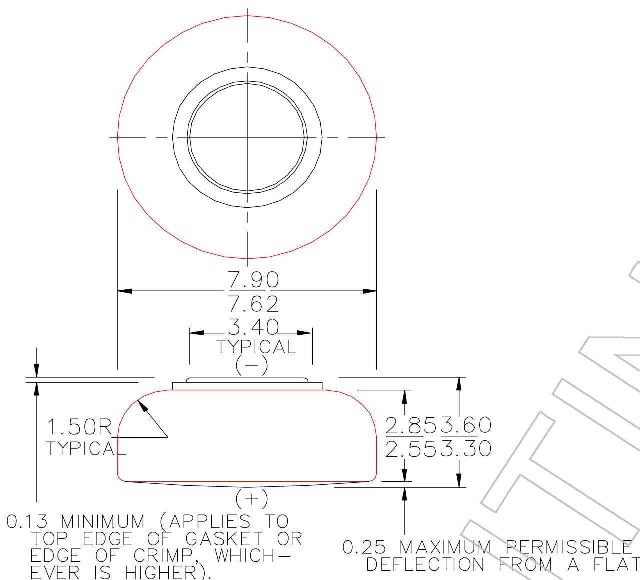
Engineering Data

ENERGIZER NO. E312E

Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1178M, IEC-NR41
Average Service Capacity (to 0.9 volts): 63 mAh
(Rated Capacity at 1,500 ohms @ 21^oC)
Typical Weight: 0.9 grams (0.03 oz.)
Volume: 0.2 cubic centimeters (0.01 cubic in.)
Terminals: Flat Contact



Dimensions (mm)

Millimeters	Inches
0.13	0.005
0.25	0.010
1.50	0.059
2.55	0.101
2.85	0.112
3.30	0.130
3.40	0.134
3.60	0.142
7.62	0.300
7.90	0.311

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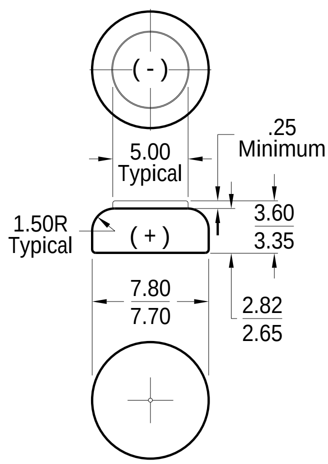
Engineering Data

ENERGIZER NO. AC312

Dimensions (mm)

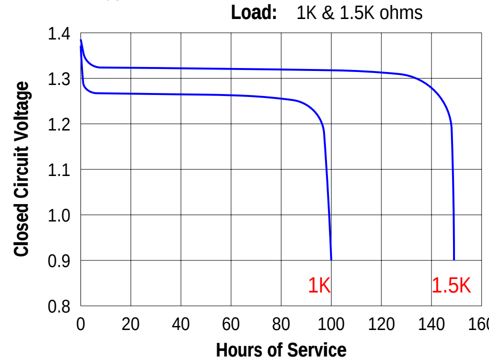


Millimeters	Inches
.25	.010
1.50	.059
2.65	.104
2.82	.111
3.35	.132
3.60	.142
5.00	.197
7.70	.303
7.80	.307

Chemical System: Zinc Air (ZnO_2)

Designation: IEC-PR41
Battery Voltage: 1.4 Volts
Average Weight: 0.5 grams (0.02 oz.)
Volume: 0.2 cubic centimeters (0.01 cubic inch)
Average Service Capacity (to 0.9 Volt): 130 mAh
(Rated capacity at 1.5K ohms at 21°C and 50%RH)
Cells: AC312

TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 16 hours/day
Typical Drain @ 1.3V: 1.3 & .87 milliamperes
Load: 1K & 1.5K ohms

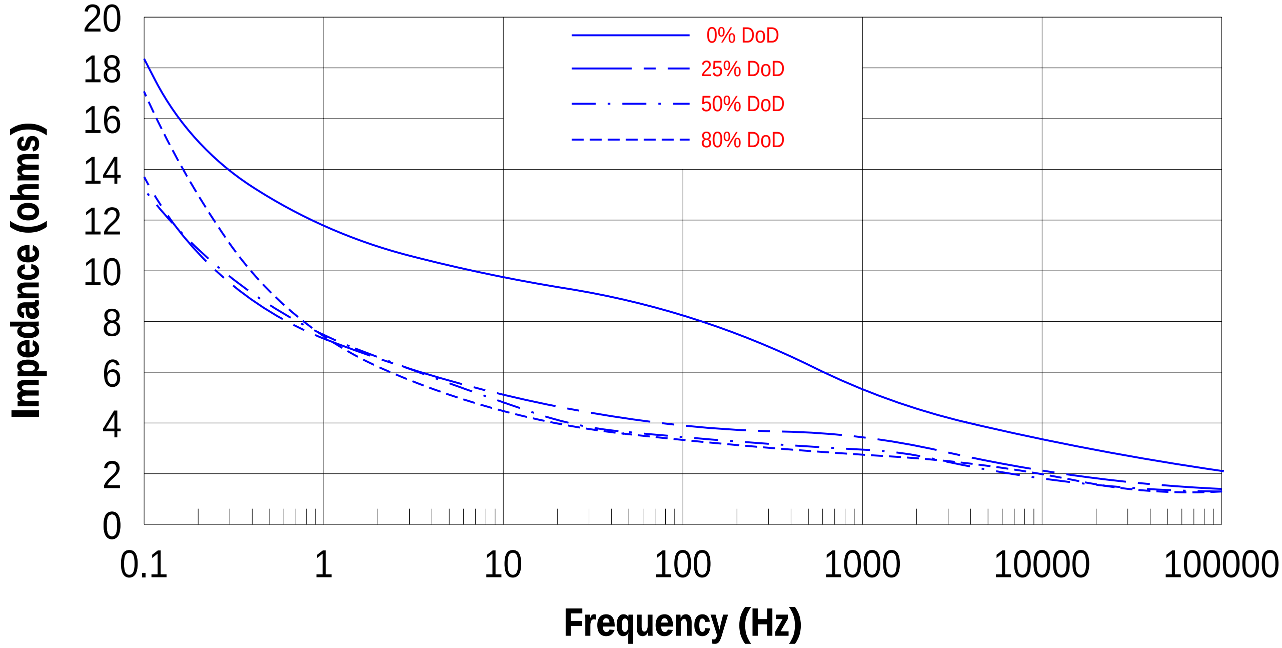


SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F) and 50% RH

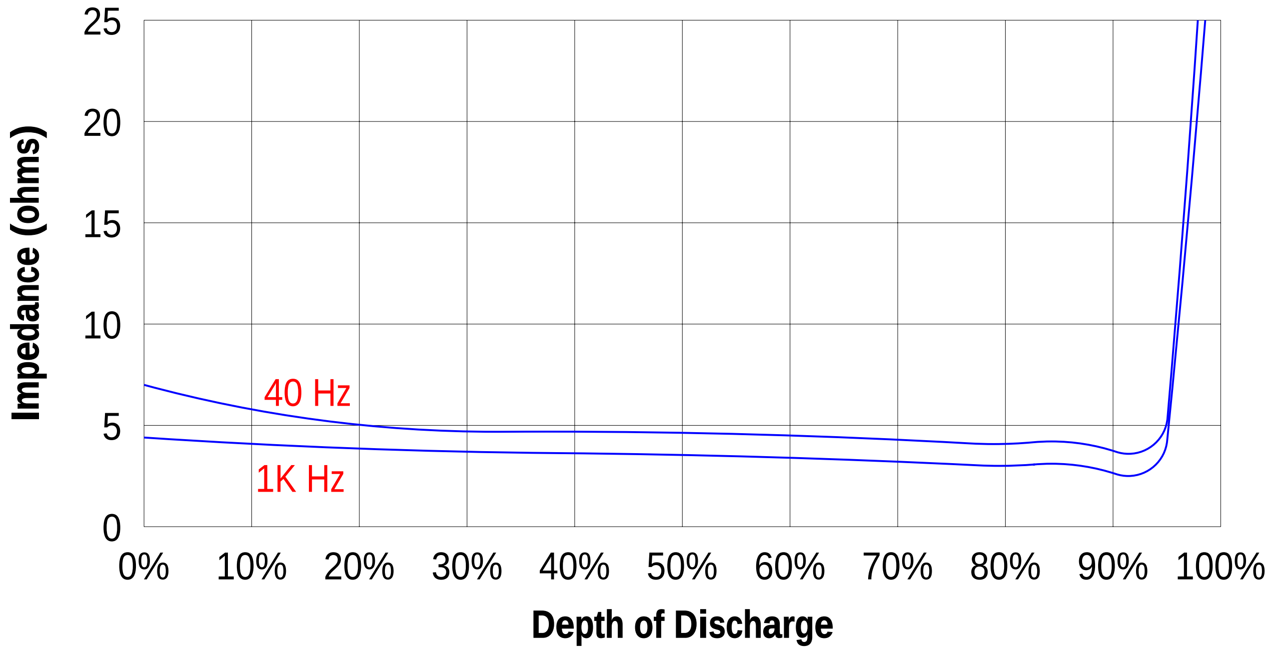
Schedule	Typical Drains @ 1.3V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 0.9V hours
16 hours / day	1.3	1,000	100
16 hours / day	.87	1,500	149

ENERGIZER NO. AC312

Impedance vs. Frequency



Impedance vs. Depth of Discharge



IMPEDANCE (Z) : The total opposition that a battery offers to the flow of alternating current.
Impedance is a combination of resistance and reactance.

IMPORTANT NOTICE

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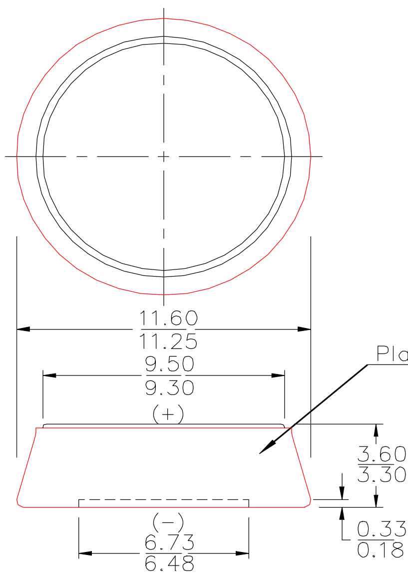
Engineering Data

ENERGIZER NO. E400N



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1116M, IEC-MR42
Average Service Capacity (to 0.9 volts): 70 mAh
(Rated Capacity at 2,500 ohms @ 21°C)
Typical Weight: 1.4 grams (0.05 oz.)
Volume: 0.3 cubic centimeters (0.02 cubic in.)
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.18	0.007
0.33	0.013
6.48	0.130
6.73	0.142
6.48	0.255
6.73	0.265
9.30	0.366
9.50	0.274
11.25	0.443
11.60	0.457

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St. Louis, MO 63164
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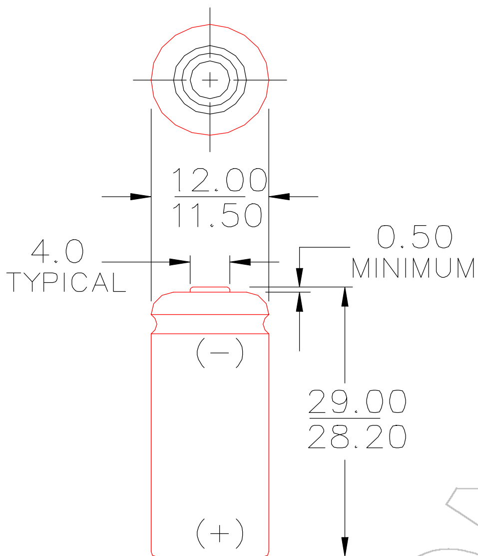
Engineering Data

ENERGIZER NO. E401E



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-910M, IEC-NR1
Average Service Capacity (to 0.9 volts): 1,100 mAh
(Rated Capacity at 300 ohms @ 21°C)
Typical Weight: 13 grams (0.46 oz.)
Volume: 3.3 cubic centimeters (0.2 cubic in.)
Terminals: Flat Contact
Cell: 401-P

Dimensions (mm)

Millimeters	Inches
0.50	0.020
4.00	0.157
11.50	0.453
12.00	0.472
28.20	1.110
29.00	1.142

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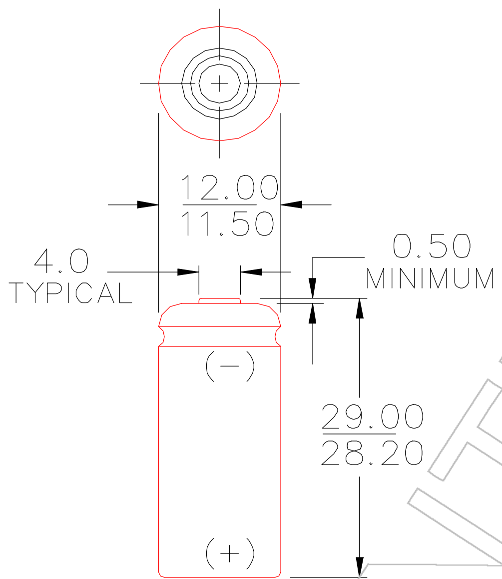
ENERGIZER NO. E401N



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-117M, IEC-MR1
Average Service Capacity (to 0.9 volts): 1,100 mAh
(Rated Capacity at 300 ohms @ 21°C)
Typical Weight: 13 grams (0.46 oz.)
Volume: 3.3 cubic centimeters (0.2 cubic in.)
Terminals: Flat Contact
Cell: 401N-P

Dimensions (mm)

Millimeters	Inches
0.50	0.020
4.00	0.157
11.50	0.453
12.00	0.472
28.20	1.110
29.00	1.142

IMPORTANT NOTICE

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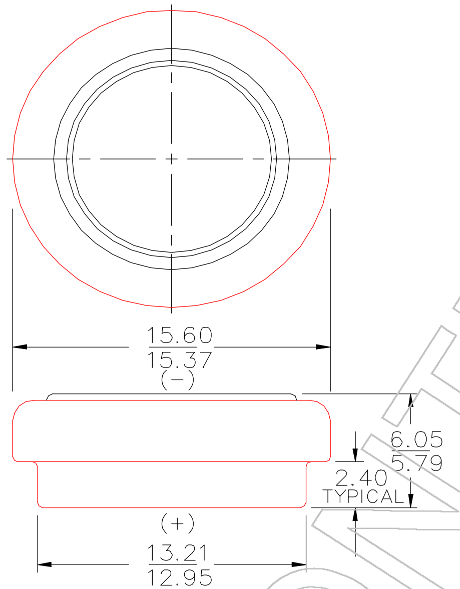
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. E625



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1123MP, IEC-MR9
Average Service Capacity (to 0.9 volts): 260 mAh
(Rated Capacity at 2,500 ohms @ 21^{o}C)
Typical Weight: 4.2 grams (0.15 oz.)
Volume: 1.2 cubic centimeters (0.07 cubic in.)
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
2.40	0.094
5.79	0.228
6.05	0.238
12.95	0.510
13.21	0.520
15.37	0.605
15.60	0.614

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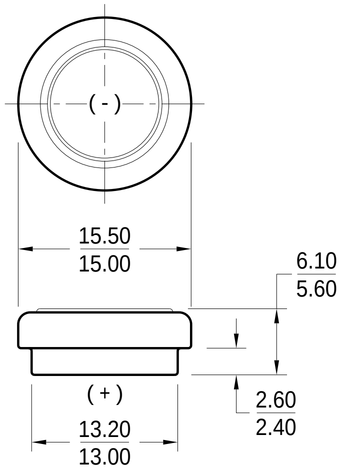
Internet: www.energizer.com

Engineering Data

ENERGIZER

ENERGIZER NO. E625G

Dimensions (mm)



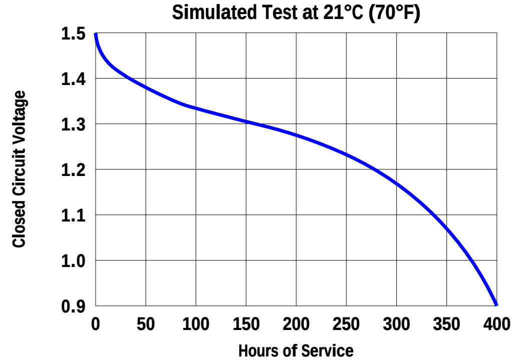
Millimeters	Inches
2.40	.094
2.60	.102
5.60	.220
6.10	.240
13.00	.512
13.20	.520
15.00	.591
15.50	.610

Chemical System: Manganese Dioxide (MnO_2)

Designation: Not Yet Available
Battery Voltage: 1.5 Volts
Average Weight: 3.3 grams (.12 oz.)
Volume: 1.20 cubic centimeters (.07 cubic inch)
Average Service Capacity (to 0.9 Volt): 200 mAh
(Rated capacity at 2.5K ohms continuous at 21°C)

DESIGNED SPECIFICALLY FOR PHOTO USE

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°F)



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.25V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 0.9V hours
24 hours / day	.500	2,500	400

INTERNAL RESISTANCE Typical closed circuit voltage no less than 1.25 volts on a load of 30 ohms at 21°C (70°F) for 0.10 to 2.0 seconds.

IMPORTANT NOTICE

Eveready Battery Company, Inc.

Checkerboard Square
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Telephone 1-800-383-7323
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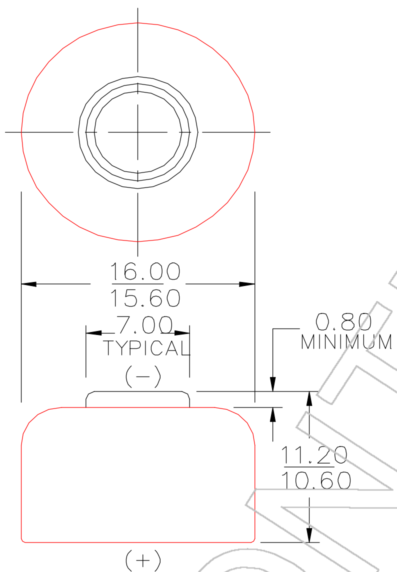
Engineering Data

ENERGIZER NO. E640



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1105M, IEC-NR52
Average Service Capacity (to 0.9 volts): 500 mAh
(Rated Capacity at 130 ohms @ 21°C)
Typical Weight: 8.0 grams (0.28 oz.)
Volume: 2.3 cubic centimeters (0.14 cubic in.)
Cells: 640-P

Dimensions (mm)

Millimeters	Inches
0.80	0.031
7.00	0.276
10.60	0.417
11.20	0.441
15.60	0.614
16.00	0.630

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Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
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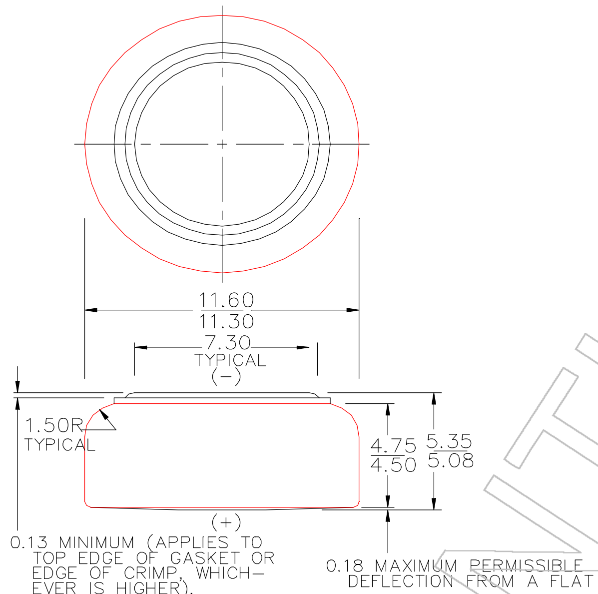
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. E675E



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1127M, IEC-NR44
Average Service Capacity (to 0.9 volts): 200 mAh
(Rated Capacity at 625 ohms @ 21°C)
Typical Weight: 42.6 grams (0.09 oz.)
Volume: 0.5 cubic centimeters (0.03 cubic in.)
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.13	0.005
0.18	0.007
1.50	0.059
4.50	0.177
4.75	0.187
5.08	0.200
5.35	0.211
7.30	0.287
11.30	0.445
11.60	0.457

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Energizer

Eveready Battery Company, Inc.

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St. Louis, MO 63164
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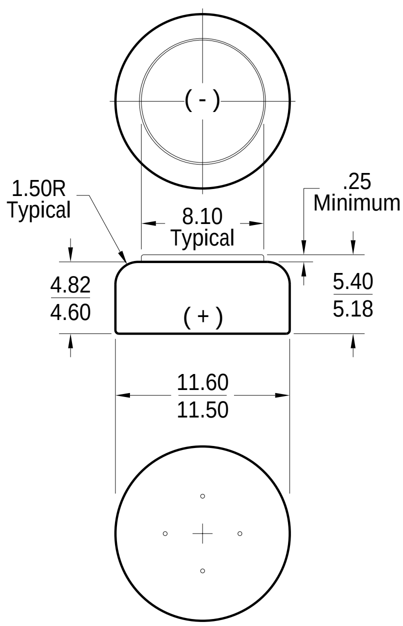
Engineering Data

ENERGIZER NO. AC675

Dimensions (mm)

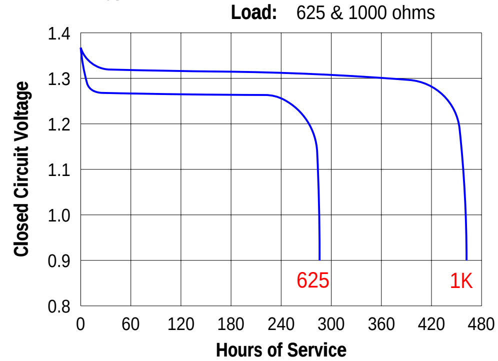


Millimeters	Inches
.25	.010
1.50	.059
4.60	.181
4.82	.190
5.18	.204
5.40	.213
8.10	.319
11.50	.453
11.60	.457

Chemical System: Zinc Air ($Zn0_2$)

Designation: IEC-PR44
Battery Voltage: 1.4 Volts
Average Weight: 1.9 grams (0.1 oz.)
Volume: 0.5 cubic centimeters (0.03 cubic inch)
Average Service Capacity (to 0.9 Volt / cell): 600 mAh
(Rated capacity at 625 ohms at 21°C and 50%RH)
Cells: AC675

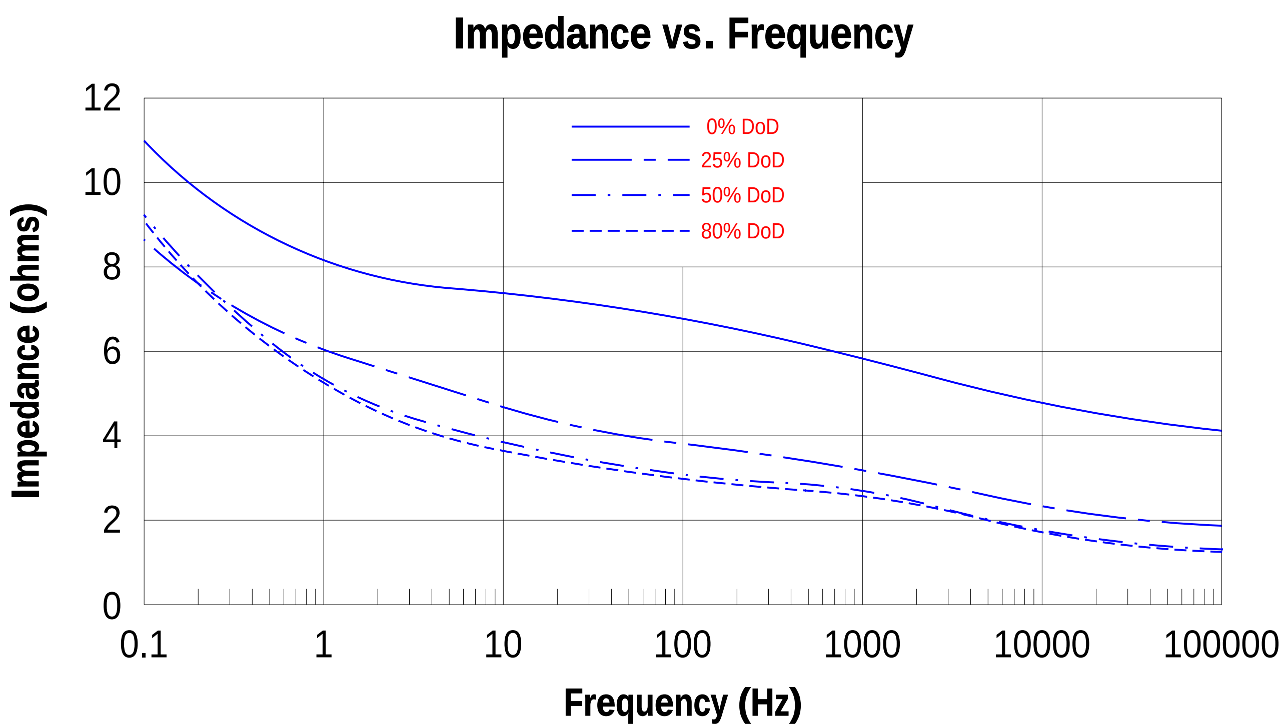
TYPICAL DISCHARGE CHARACTERISTICS
Schedule: 16 hours/day
Typical Drain @ 1.3V: 2.1 & 1.3 milliamperes
Load: 625 & 1000 ohms

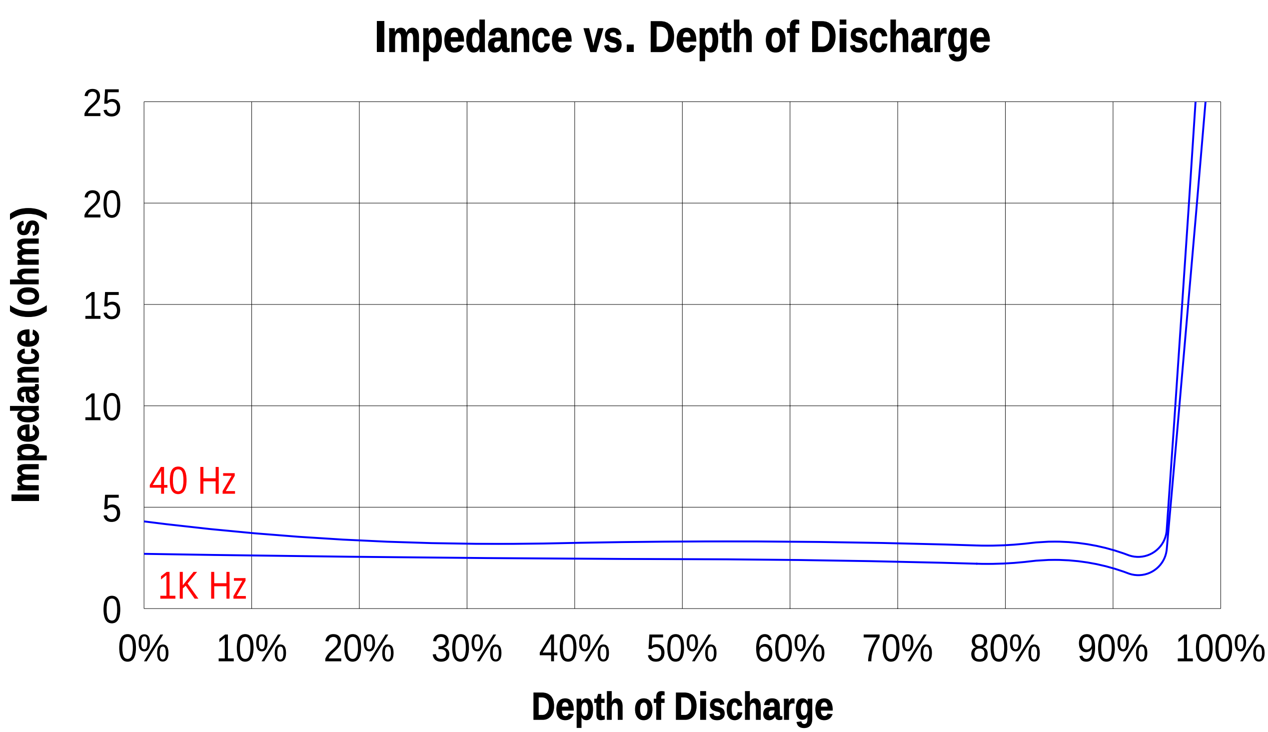


SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F) and 50% RH

Schedule	Typical Drains @ 1.3V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 0.9V hours
16 hours / day	2.1	625	286
16 hours / day	1.3	1,000	462

ENERGIZER NO. AC675





IMPEDANCE (Z) : The total opposition that a battery offers to the flow of alternating current.
Impedance is a combination of resistance and reactance.

IMPORTANT NOTICE

Eveready Battery Company, Inc.

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Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

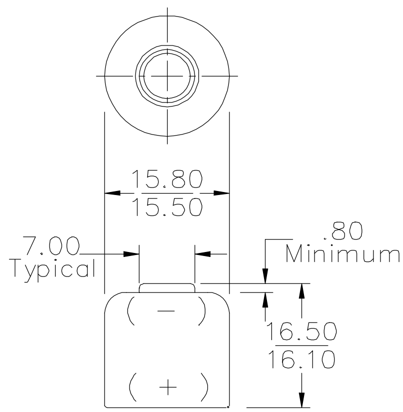
Alkaline ***1.5V***
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EN1A

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-1100A, IEC-LR50
Battery Voltage: 1.5 Volts
Typical Weight: 8.3 grams (0.3 oz.)
Volume: 3.2 cubic centimeters (0.2 cubic inch)
Average Service capacity (to 1.8 Volt): 650 mAh
(Rated Capacity at 220 ohms continuous at 20°C)
Cell: 1A-P

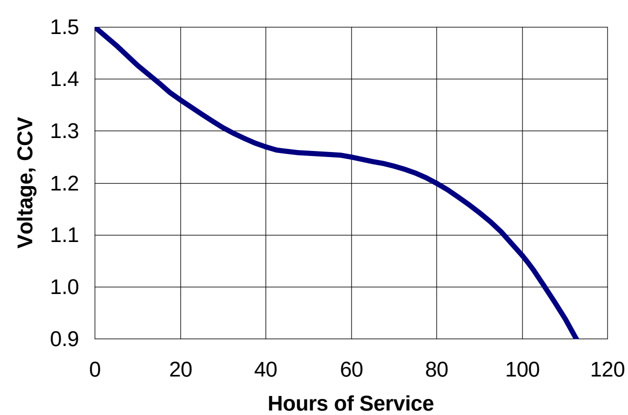
Dimensions (mm)

Millimeters	Inches
0.80	0.031
7.00	0.276
15.50	0.610
15.80	0.622
16.10	0.634
16.50	0.650



DESIGNED SPECIFICALL FOR PHOTO USE

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°C)



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains 1.25V (milliamperes)	Load (ohms)	Cutoff Voltage 0.9V hours
24 hours / day	5.7	220	114

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Eveready Battery Company, Inc.

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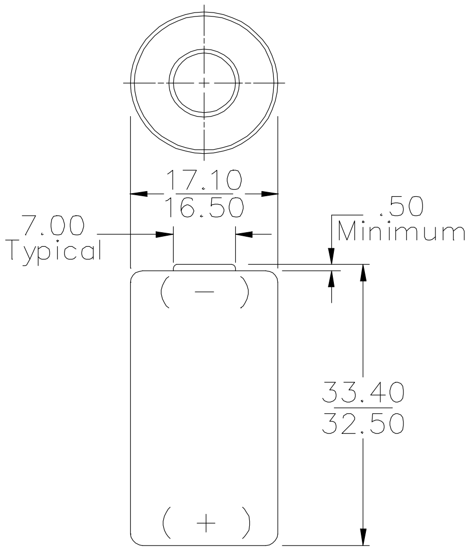
Engineering Data

Alkaline ***3V***
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EN132A

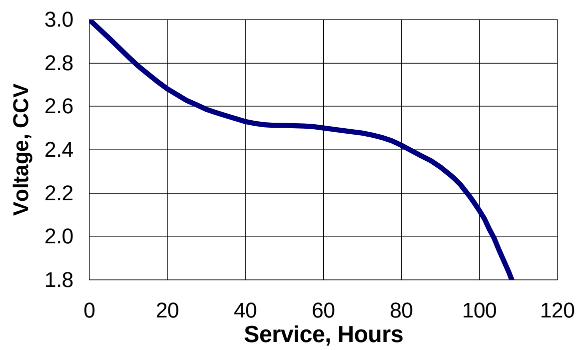


Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-1200A, IEC-2LR50
Battery Voltage: 3.0 Volts
Typical Weight: 18 grams (0.6 oz.)
Volume: 7.7 cubic centimeters (0.5 cubic inch)
Average Service capacity (to 1.8 Volt): 650 mAh
(Rated Capacity at 440 ohms continuous at 20^{o}C)
Cell: Two No. 1A-P in series

Dimensions (mm)

Millimeters	Inches
0.50	0.020
7.00	0.276
16.50	0.650
17.10	0.673
32.50	1.280
33.40	1.315

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21^{o}C (70^{o}F)



SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains 2.5V (milliamperes)	Load (ohms)	Cutoff Voltage 1.8V hours
24 hours / day	5.7	440	114

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Eveready Battery Company, Inc.

533 Maryville University Drive
St. Louis, MO 63141
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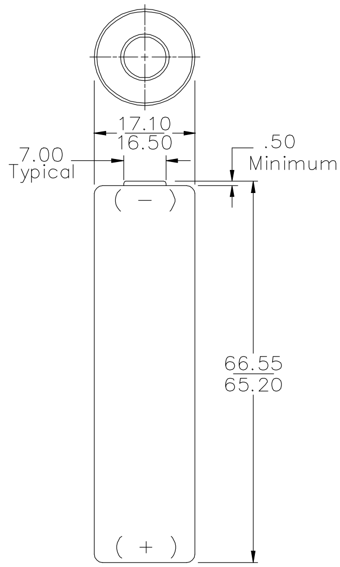
Internet: www.energizer.com

Engineering Data

Alkaline ***6V***
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EN134A

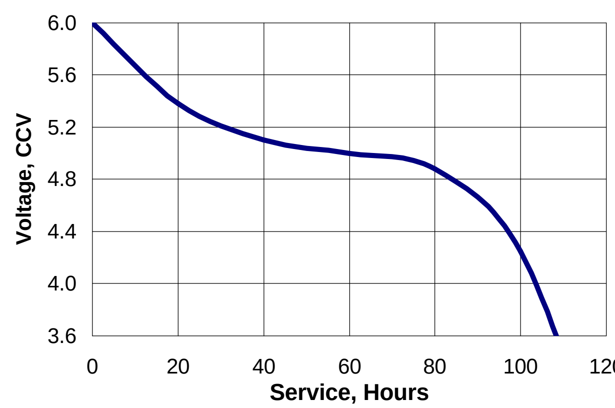


Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-1409A, IEC-4LR50
Battery Voltage: 6.0 Volts
Typical Weight: 36 grams (1.3 oz.)
Volume: 15.3 cubic centimeters (0.9 cubic inch)
Average Service capacity (to 3.6 Volt): 650 mAh
(Rated Capacity at 880 ohms continuous at 20^{o}C)
Cell: Four No. 1A-P in series

Dimensions (mm)

Millimeters	Inches
0.50	0.020
7.00	0.276
16.50	0.650
17.10	0.673
65.20	2.567
66.55	2.620

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21^{o}C (70^{o}F)



SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains 5.0V (milliamperes)	Load (ohms)	Cutoff Voltage 3.6V hours
24 hours / day	5.7	880	114

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Eveready Battery Company, Inc.

533 Maryville University Drive
St. Louis, MO 63141
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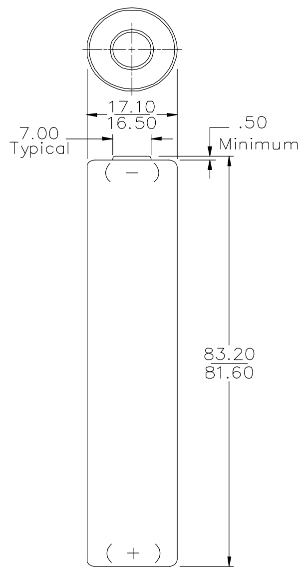
Engineering Data

Alkaline ***7.5V***
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EN135A

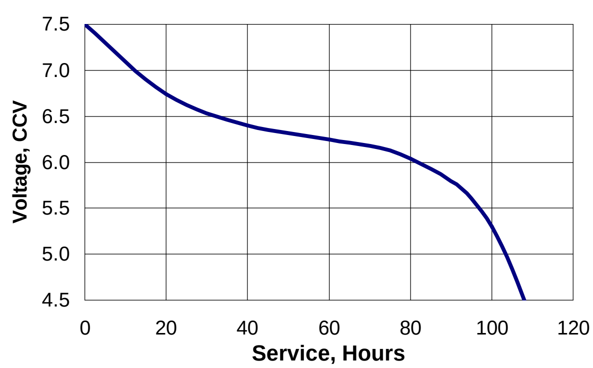


Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-1505A, IEC-5LR50
Battery Voltage: 7.5 Volts
Typical Weight: 45 grams (1.6 oz.)
Volume: 18.3 cubic centimeters (1.1 cubic inch)
Average Service capacity (to 4.5 Volt): 650 mAh
(Rated Capacity at 1.1K ohms continuous at 20°C)
Cell: Five No. 1A-P in series

Dimensions (mm)

Millimeters	Inches
0.50	0.020
7.00	0.276
16.50	0.650
17.10	0.673
81.60	3.213
83.20	3.276

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°C)



SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains 6.25V (milliamperes)	Load (ohms)	Cutoff Voltage 4.5V hours
24 hours / day	5.7	1100	114

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Checkerboard Square
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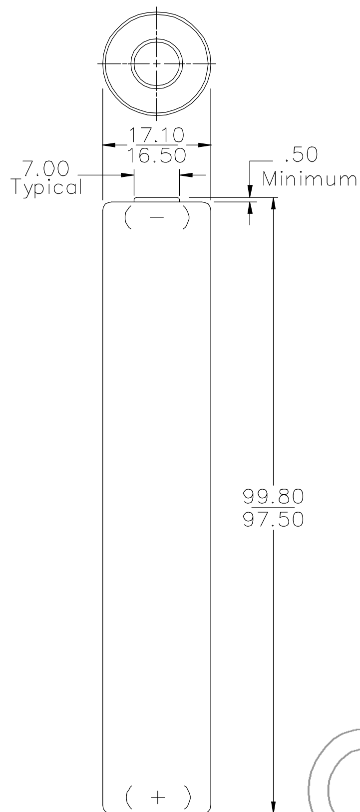
Engineering Data

Alkaline ***9V***
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EN136A

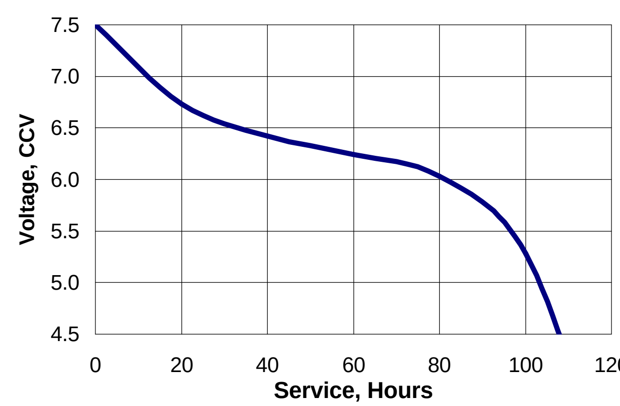


Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-1615A, IEC-6LR50
Battery Voltage: 9.0 Volts
Typical Weight: 54 grams (1.9 oz.)
Volume: 22.9 cubic centimeters (1.4 cubic inch)
Average Service capacity (to 5.4 Volt): 650 mAh
(Rated Capacity at 1.32K ohms continuous at 20^{o}C)
Cell: Six No. 1A-P in series

Dimensions (mm)

Millimeters	Inches
0.50	0.020
7.00	0.276
16.50	0.650
17.10	0.673
97.50	3.839
99.80	3.929

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21^{o}C (70^{o}C)



SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains 7.5V (milliamperes)	Load (ohms)	Cutoff Voltage 5.4V hours
24 hours / day	5.7	1320	114

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St. Louis, MO 63141
Telephone 1-800-383-7323
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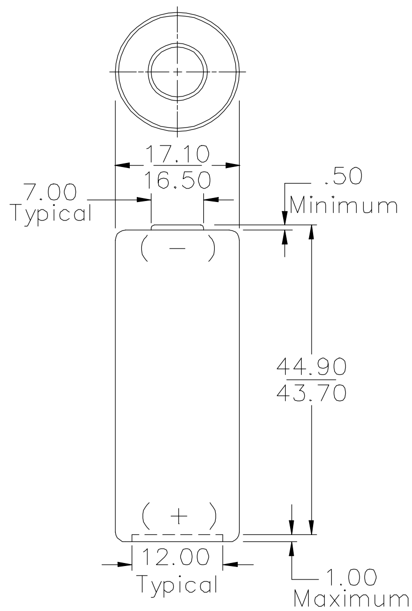
Engineering Data

Alkaline ***6V***
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EN164A



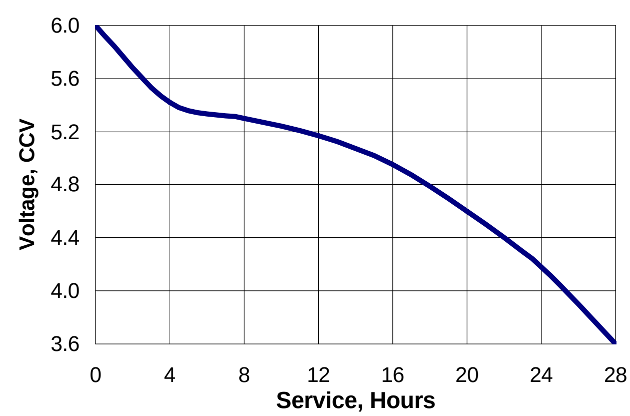
DESIGNED SPECIFICALLY FOR PHOT USE

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-1404A, IEC-4LR52
Battery Voltage: 6.0 Volts
Typical Weight: 25.5 grams (0.9 oz.)
Volume: 10.3 cubic centimeters (0.6 cubic inch)
Average Service capacity (to 3.6 Volt): 335 mAh
(Rated Capacity at 400 ohms continuous at 20^{o}C)
Cell: Four No. 640A-P in series

Dimensions (mm)

Millimeters	Inches
0.50	0.020
1.00	0.039
7.00	0.276
12.00	0.472
16.50	0.650
17.10	0.673
43.70	1.720
44.90	1.768

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21^{o}C (70^{o}F)



SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains 5.0V (milliamperes)	Load (ohms)	Cutoff Voltage 3.6V hours
24 hours / day	12.5	400	28

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St. Louis, MO 63141
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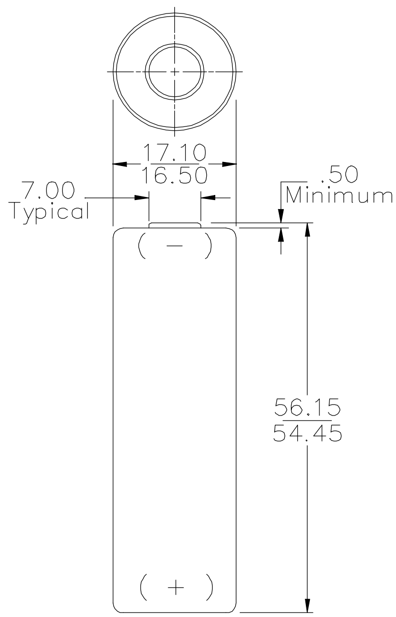
Engineering Data

Alkaline ***7.5V***
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EN165A

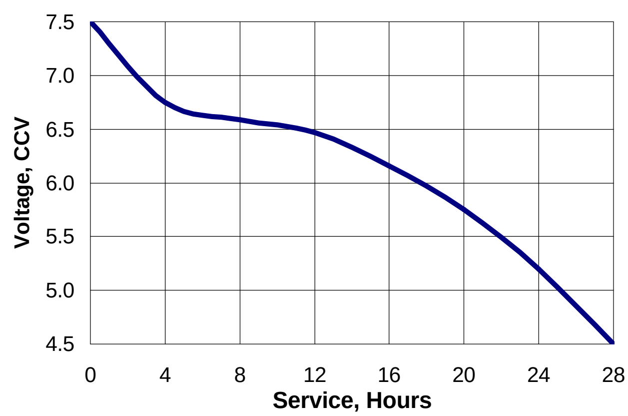


Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-1500A, IEC-5LR52
Battery Voltage: 7.5 Volts
Typical Weight: 31.5 grams (1.1 oz.)
Volume: 12.9 cubic centimeters (0.8 cubic inch)
Average Service capacity (to 3.6 Volt): 335 mAh
(Rated Capacity at 500 ohms continuous at 20°C)
Cell: Five No. 640A-P in series

Dimensions (mm)

Millimeters	Inches
0.50	0.020
7.00	0.276
16.50	0.650
17.10	0.673
54.45	2.144
56.15	2.211

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°C)



SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains 6.25V (milliamperes)	Load (ohms)	Cutoff Voltage 4.5V hours
24 hours / day	12.5	500	28

IMPORTANT NOTICE

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Eveready Battery Company, Inc.

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St. Louis, MO 63141
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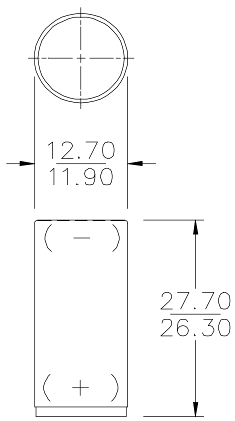
Internet: www.energizer.com

Engineering Data

Alkaline ***7.5V***
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EN175A

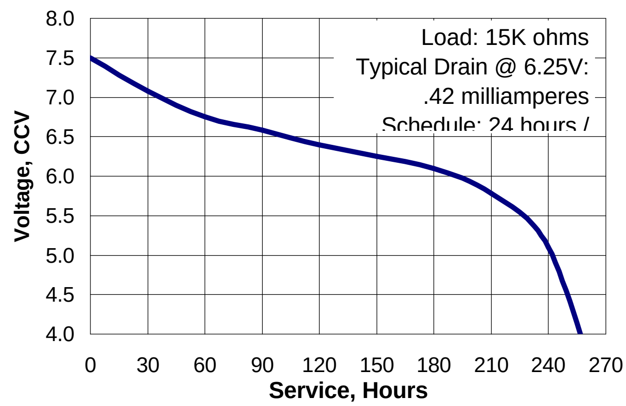


Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-1501A, IEC-5LR44
Battery Voltage: 7.5 Volts
Typical Weight: 9.5 grams (0.3 oz.)
Volume: 3.5 cubic centimeters (0.2 cubic inch)
Average Service capacity (to 1.8 Volt): 110 mAh
(Rated Capacity at 15K ohms continuous at 20°C)
Cell: Five No. 675A-P in series

Dimensions (mm)

Millimeters	Inches
11.90	0.469
12.70	0.500
26.30	1.035
27.70	1.091

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°C)



SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains 6.25V (milliamperes)	Load (ohms)	Cutoff Voltage 4.5V hours
24 hours / day	2.1	3000	50
24 hours / day	0.42	15000	255

IMPORTANT NOTICE

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Eveready Battery Company, Inc.

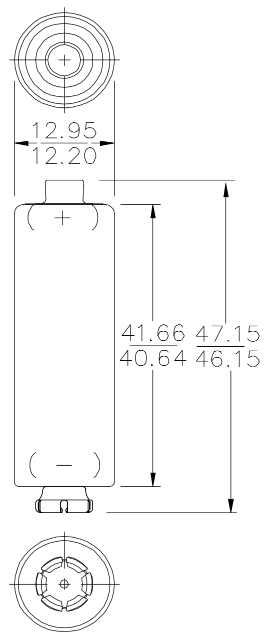
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Alkaline ***10.5V***
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EN177A

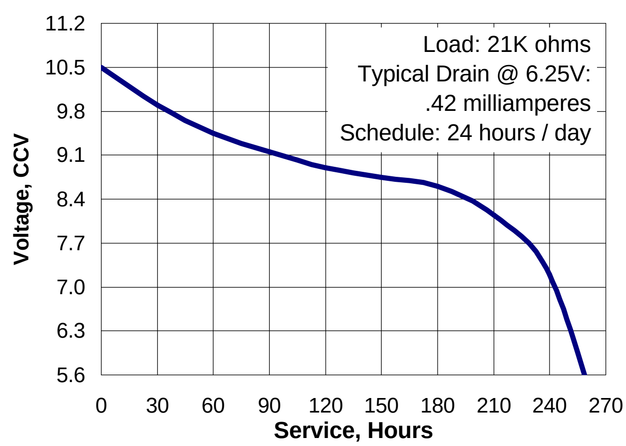
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-1606A, IEC-7LR44
Battery Voltage: 10.5 Volts
Typical Weight: 14 grams (0.5 oz.)
Volume: 6.2 cubic centimeters (0.4 cubic inch)
Average Service capacity (to 1.8 Volt): 110 mAh
(Rated Capacity at 21K ohms continuous at 20°C)
Cell: Seven No. 675A-P in series



Dimensions (mm)

Millimeters	Inches
12.20	0.480
12.95	0.510
40.64	1.600
41.66	1.640
46.15	1.817
47.15	1.856

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°F)



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains 6.25V (milliamperes)	Load (ohms)	Cutoff Voltage 4.5V (hours)	Cutoff Voltage 5.4V (hours)	Cutoff Voltage 6.3V (hours)
24 hours / day	0.42	21000	-	-	255
16 hours / day	23.30	375	-	-	53
2 hours / day	8.75	1000	25	23	21
4 hours / day	11.70	750	20	19	18

DISCONTINUED

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Eveready Battery Company, Inc.

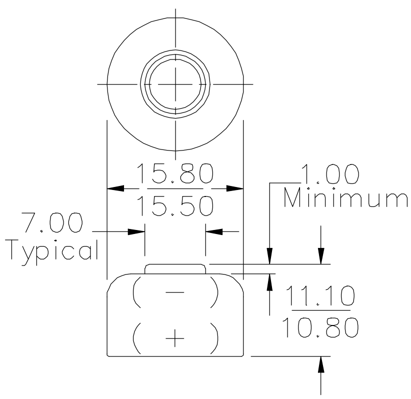
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Alkaline ***1.5V***
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EN640A

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-1126A, IEC-LR52
Battery Voltage: 1.5 Volts
Typical Weight: 6 grams (0.2 oz.)
Volume: 2.2 cubic centimeters (0.1 cubic inch)
Average Service capacity (to 0.9 Volt): 335 mAh
(Rated Capacity at 100 ohms continuous at 20°C)
Cell: 640A-P

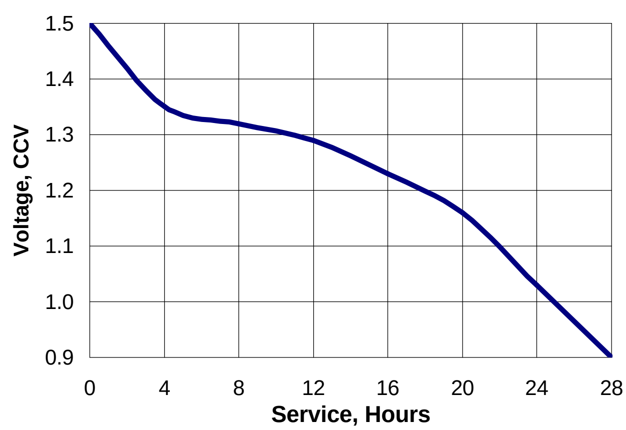


Dimensions (mm)

Millimeters	Inches
1.00	0.039
7.00	0.276
10.80	0.425
11.10	0.437
15.50	0.610
15.80	0.622

DESIGNED SPECIFICALLY FOR PHOTO USE

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°F)



SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains 1.25V (milliamperes)	Load (ohms)	Cutoff Voltage 0.9V hours
24 hours / day	12.5	100	28

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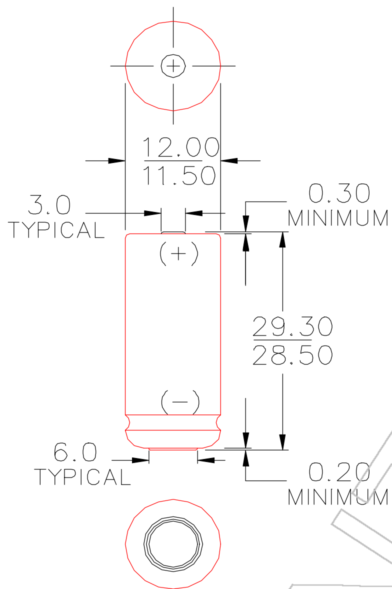
Energizer

Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. EP401E



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1118M, IEC-NR1
Average Service Capacity (to 0.9 volts): 1,100 mAh
(Rated Capacity at 300 ohms @ 21°C)
Typical Weight: 13 grams (0.46 oz.)
Volume: 3.3 cubic centimeters (0.2 cubic in.)
Terminals: Flat Contact
Cell: P401-P

Dimensions (mm)

Millimeters	Inches
0.20	0.005
0.30	0.007
3.00	0.059
6.00	0.177
11.50	0.187
2.00	0.200
28.50	0.211
29.30	0.287

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St. Louis, MO 63164
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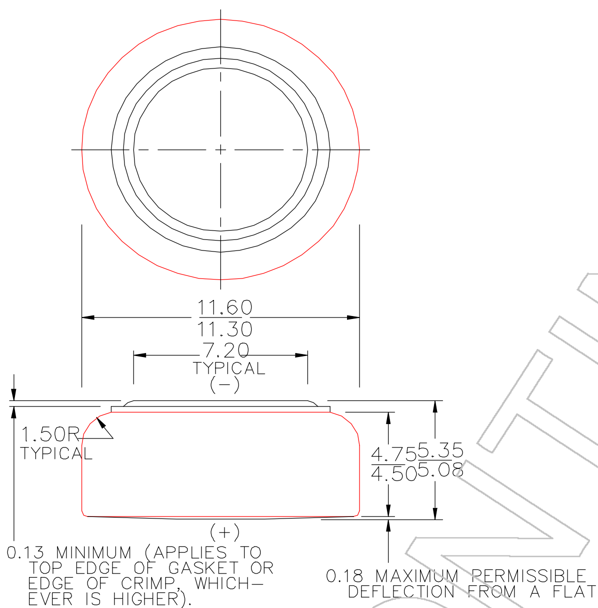
Engineering Data

ENERGIZER NO. EP675E



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1127MD, IEC-NR44
Average Service Capacity (to 0.9 volts): 270 mAh
(Rated Capacity at 625 ohms @ 21°C)
Typical Weight: 2.6 grams (0.09 oz.)
Volume: 0.5 cubic centimeters (0.03 cubic in.)
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.13	0.005
0.18	0.007
1.50	0.059
4.50	0.177
4.75	0.187
5.08	0.200
5.35	0.211
7.20	0.283
11.30	0.445
11.60	0.457

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Checkerboard Square
St. Louis, MO 63164
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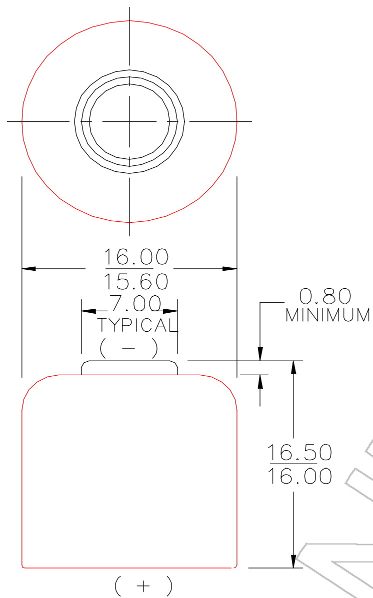
Engineering Data

ENERGIZER NO. EPX1



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1100MP, IEC-MR50
Average Service Capacity (to 0.9 volts): 1,000 mAh
(Rated Capacity at 62 ohms @ 21°C)
Typical Weight: 14.3 grams (0.5 oz.)
Volume: 3.3 cubic centimeters (0.2 cubic in.)
Terminals: Flat Contact
Cell: PX1-P

Dimensions (mm)

Millimeters	Inches
0.80	0.005
7.00	0.007
15.60	0.059
16.00	0.177
16.50	0.187

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Eveready Battery Company, Inc.

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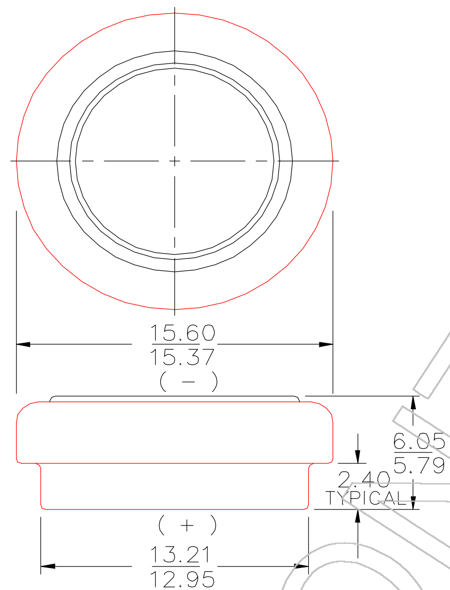
Engineering Data

ENERGIZER NO. EPX13



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1114MP, IEC-MR9
Average Service Capacity (to 0.9 volts): 260 mAh
(Rated Capacity at 2,500 ohms @ 21°C)
Typical Weight: 4.2 grams (0.15 oz.)
Volume: 1.2 cubic centimeters (0.07 cubic in.)
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
2.40	0.094
5.79	0.228
6.05	0.238
12.95	0.510
13.21	0.520
15.37	0.605
15.60	0.614

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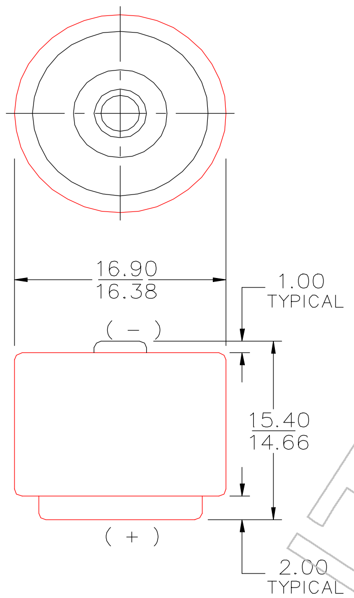
Engineering Data

ENERGIZER NO. EPX14



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1201MP, IEC-2MR9
Average Service Capacity (to 1.8 volts): 260 mAh
(Rated Capacity at 5,000 ohms @ 21^{o}C)
Typical Weight: 8.3 grams (0.3 oz.)
Volume: 3.3 cubic centimeters (0.2 cubic in.)
Terminals: Flat Contact
Cell: Two PX625 in series

Dimensions (mm)

Millimeters	Inches
1.00	0.039
2.00	0.070
14.66	0.577
15.40	0.606
16.38	0.645
16.90	0.665

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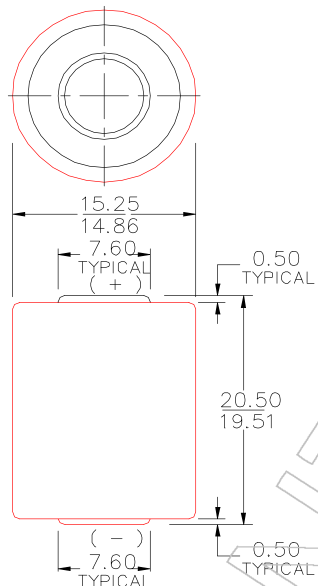
Engineering Data

ENERGIZER NO. EPX23



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1407MP, IEC-4NR43
Average Service Capacity (to 3.6 volts): 155 mAh
(Rated Capacity at 2,500 ohms @ 21°C)
Typical Weight: 7.8 grams (0.28 oz.)
Volume: 3.4 cubic centimeters (0.21 cubic in.)
Terminals: Flat Contact
Cells: Four 41 in series
Jacket: Metal

Dimensions (mm)

Millimeters	Inches
0.50	0.020
7.60	0.299
14.86	0.585
15.25	0.600
19.51	0.768
20.50	0.807

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Energizer

Eveready Battery Company, Inc.

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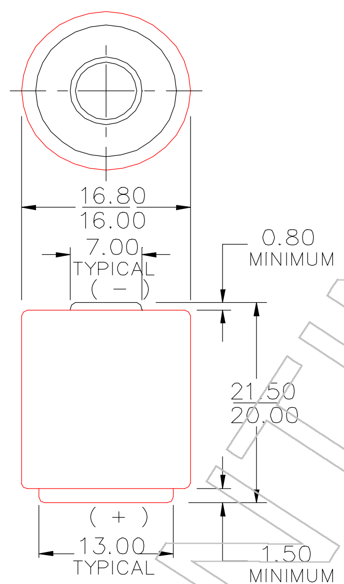
Engineering Data

ENERGIZER NO. EPX25



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1311MP, IEC-3MR9
Average Service Capacity (to 2.7 volts): 280 mAh
(Rated Capacity at 910 ohms @ 21^{o}C)
Typical Weight: 15 grams (0.53 oz.)
Volume: 4.8 cubic centimeters (0.29 cubic in.)
Terminals: Flat Contact
Cells: Three PX625-P in series

Dimensions (mm)

Millimeters	Inches
0.80	0.031
1.50	0.059
7.00	0.276
13.00	0.512
16.00	0.630
16.80	0.661
20.00	0.787
21.50	0.846

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Eveready Battery Company, Inc.

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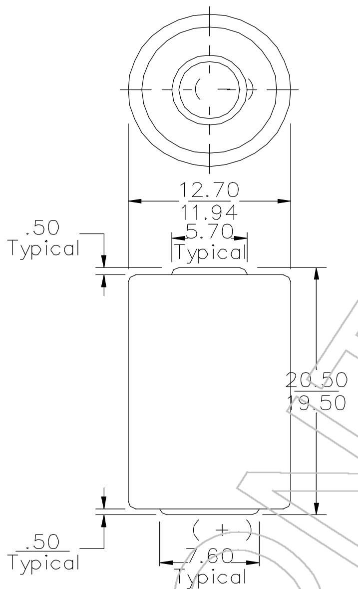
Engineering Data

ENERGIZER NO. EPX27



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1413MP, IEC-4RN43
Average Service Capacity (to 3.6 volts): 155 mAh
(Rated Capacity at 2.5K ohms @ 21°C)
Typical Weight: 7.7 grams (0.27 oz.)
Volume: 2.3 cubic centimeters (0.14 cubic in.)
Cells: Four 41 in series

Dimensions (mm)

Millimeters	Inches
0.50	0.020
5.70	0.224
7.60	0.299
11.94	0.470
12.70	0.500
19.51	0.768
20.50	0.807

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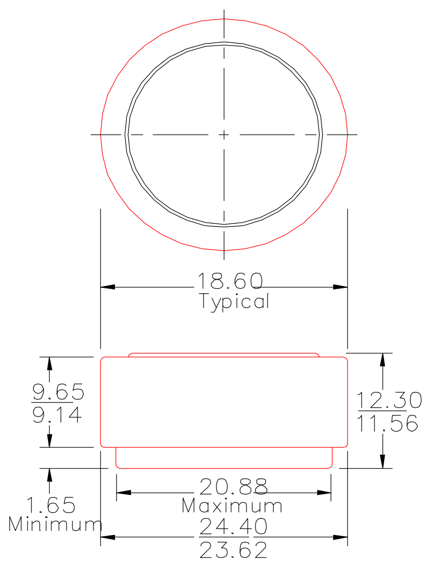
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. EPX30



Chemical System: Manganese Dioxide (MnO_2)
Designation: ANSI / NEDA-1202AP, IEC-2LR53
Typical Capacity (to 1.8V): 160 mAh
(Rated capacity at 600 ohms @ 21°C)
Typical Weight: 14 grams (0.5 oz.)
Volume: 5.4 cubic centimeters (0.33 cubic in.)
Cells: Two 1522 in series
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
1.65	0.065
9.14	0.360
9.65	0.380
11.56	0.455
12.30	0.484
18.60	0.732
20.86	0.821
23.62	0.930
24.40	0.961

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Energizer

Eveready Battery Company, Inc.

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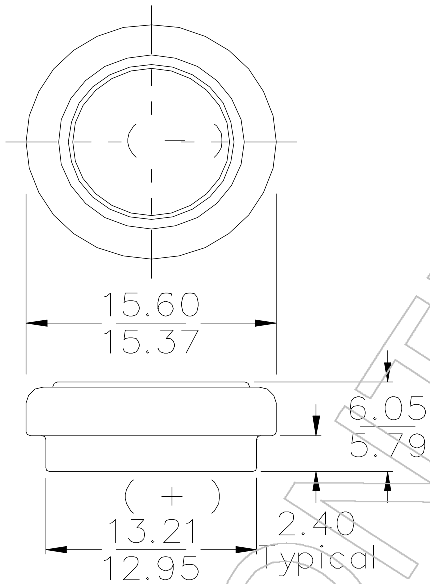
Engineering Data

ENERGIZER NO. EPX625



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1124MP, IEC-MR9
Voltage: 1.35V
Average Service Capacity (to 0.9 volts): 260 mAh
(Rated Capacity at 2.5K ohms @ 21°C)
Typical Weight: 4.2 grams (0.15 oz.)
Volume: 1.2 cubic centimeters (0.07 cubic in.)

Dimensions (mm)

Millimeters	Inches
2.40	0.094
5.79	0.228
6.05	0.238
12.95	0.510
13.21	0.520
15.37	0.605
15.60	0.614

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St. Louis, MO 63164
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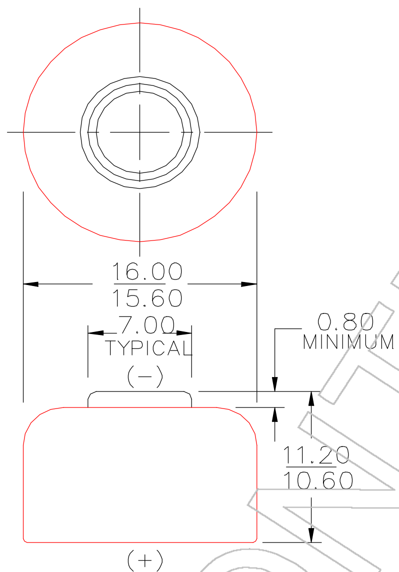
Engineering Data

ENERGIZER NO. EPX640



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1126MP, IEC-MR52
Average Service Capacity (to 0.9 volts): 500 mAh
(Rated Capacity at 130 ohms @ 21°C)
Typical Weight: 8.5 grams (0.3 oz.)
Volume: 2.3 cubic centimeters (0.14 cubic in.)
Cells: PX640-P

Dimensions (mm)

Millimeters	Inches
0.80	0.031
7.00	0.276
10.60	0.417
11.20	0.441
15.60	0.614
16.00	0.630

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St. Louis, MO 63164
Telephone 1-800-383-7323
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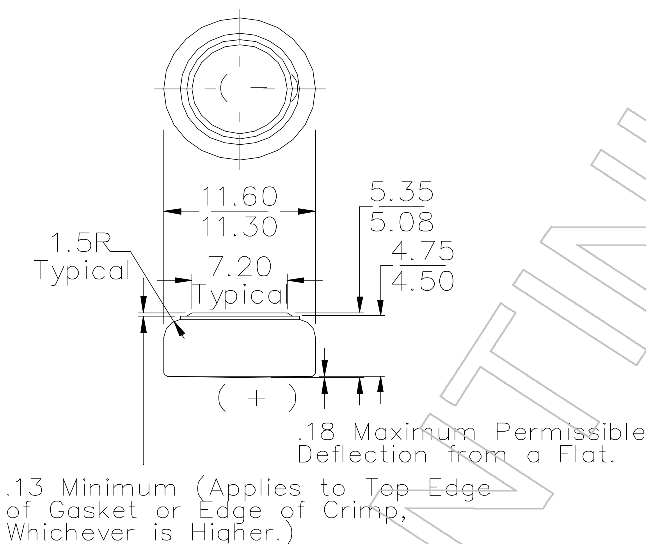
Engineering Data

ENERGIZER NO. EPX675



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-1128MP, IEC-MR44
Voltage: 1.35V
Average Service Capacity (to 0.9 volts): 240 mAh
(Rated Capacity at 2.5K ohms @ 21^{o}C)
Typical Weight: 2.6 grams (0.09 oz.)
Volume: 0.5 cubic centimeters (0.03 cubic in.)

Dimensions (mm)

Millimeters	Inches
0.13	0.005
0.18	0.007
1.50	0.059
4.50	0.177
4.75	0.187
5.08	0.200
5.35	0.211
7.20	0.283
11.30	0.445
11.60	0.457

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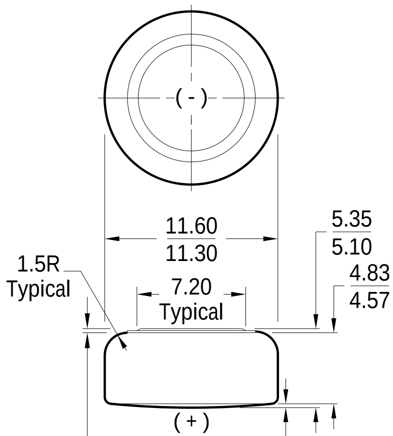
Engineering Data

ENERGIZER NO. EPX76

ENERGIZER

Dimensions (mm)



Millimeters	Inches
.13	.005
.20	.008
1.50	.059
4.57	.180
4.83	.190
5.10	.201
5.35	.211
7.20	.283
11.30	.445
11.60	.457

Chemical System: Silver Oxide ($Zn/Ag_2 0$)

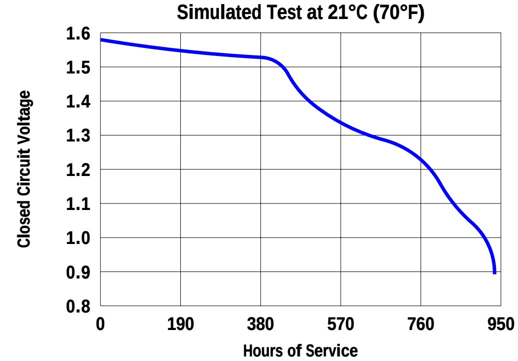
Designation: ANSI / NEDA-1107SOP, IEC-SR44
Battery Voltage: 1.55 Volts
Average Weight: 2.27 grams (.08 oz.)
Volume: .57 cubic centimeters (.035 cubic inch)
Average Service Capacity (to 0.9 Volt): 200 mAh
(Rated capacity at 6.5K ohms continuous at 21°C)

DESIGNED SPECIFICALLY FOR PHOTO USE

SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.40V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 0.9V hours
24 hours / day	.215	6,500	935

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°F)



INTERNAL RESISTANCE Closed circuit voltage no less than 1.30 volts on a load of 100 ohms at 21°C (70°F) for 0.1 to 2.0 seconds.

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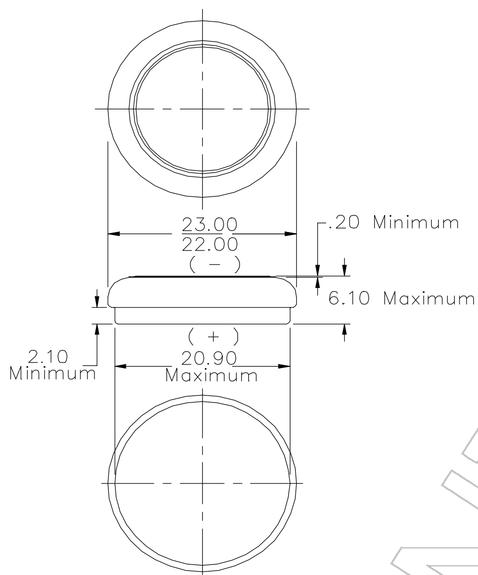
Engineering Data

ENERGIZER NO. EPX825



Chemical System: Manganese Dioxide (MnO_2)
Designation: N/A
Typical Capacity (to 0.9V): 350 mAh
(Rated capacity at 150 ohms continuous @ 21°C)
Typical Weight: 7.2 grams (0.254 oz.)
Volume: 2.53 cubic centimeters (0.155 cubic in.)
Terminals: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.20	0.008
2.10	0.083
6.10	0.240
20.90	0.823
22.60	0.866
23.00	0.906

IMPORTANT NOTICE

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

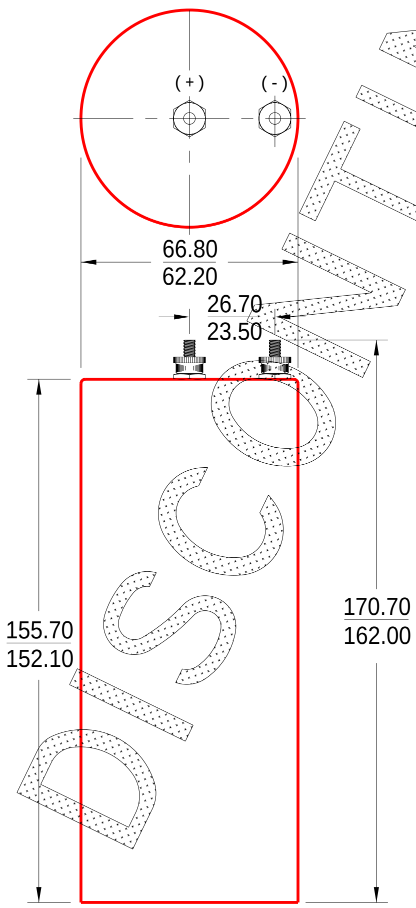
EVEREADY NO. EV6

LeClanche ***1.5V***

NOT INTENDED FOR RETAIL TRADE

Chemical System: LeClanche-Manganese Dioxide ($Zn/Mn0_2$)

Designation: ANSI / NEDA-905, IEC-R40
Battery Voltage: 1.5 Volts
Average Weight: 710 grams (25.0 oz.)
Volume: 492 cubic centimeters (30.0 cubic inch)
Cells: One No. 6P
Jacket: Plastic



Dimensions (mm)

Millimeters	Inches
23.50	.925
26.70	1.051
62.20	2.449
66.80	2.630
152.10	5.988
155.70	6.130
162.00	6.378
170.70	6.720

Less Than 125 Parts per Million Mercury
Consult Eveready For Current Zero Added Mercury Status

Eveready Battery Company, Inc.

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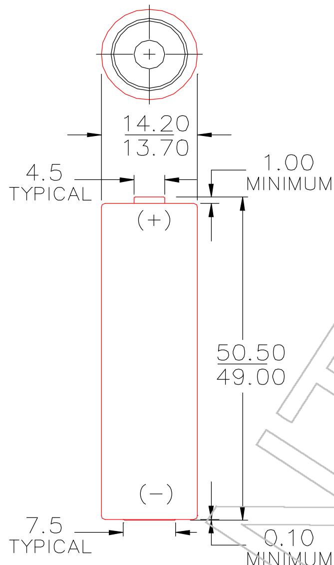
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. EV9



Chemical System: Mercuric Oxide (Zn/HgO)
Designation: ANSI / NEDA-15M, IEC-NR6
Average Service Capacity (to 0.9 volts): 2,600 mAh
(Rated Capacity at 24 ohms @ 21^{o}C)
Typical Weight: 31 grams (1.09 oz.)
Volume: 8.0 cubic centimeters (0.49 cubic in.)
Cells: 9-P
Jacket: Metal (Green)
Terminal: Flat Contact

Dimensions (mm)

Millimeters	Inches
0.10	0.004
1.00	0.039
4.50	0.177
7.50	0.295
13.70	0.539
14.20	0.559
49.00	1.929
50.50	1.988

IMPORTANT NOTICE

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

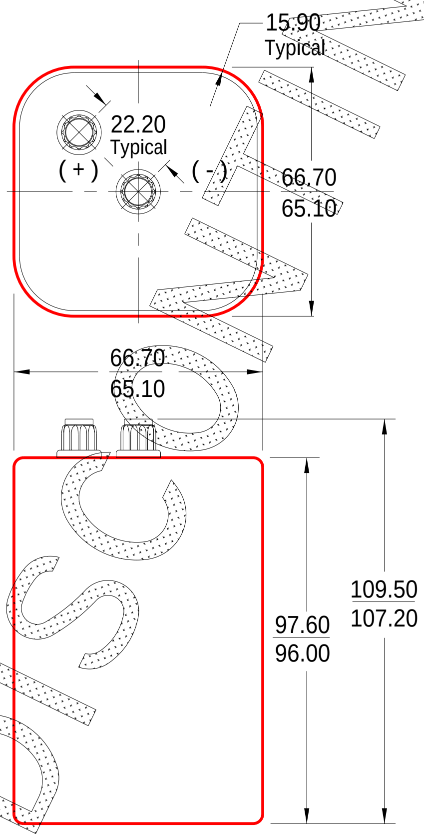
Engineering Data

EVEREADY NO. EV10S

Zinc Chloride ***6V***
General Purpose
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

Chemical System: Zinc-Manganese Dioxide ($Zn/Mn0_2$)

Designation: ANSI / NEDA-915, IEC-4R25
Battery Voltage: 6 Volts
Average Weight: 632 grams (22.3 oz.)
Volume: 434 cubic centimeters (26.5 cubic inch)
Cells: Four No. 60 (size "F") in series.
Jacket: Metal



Dimensions (mm)

Millimeters	Inches
15.90	.626
22.20	.874
65.10	2.563
66.70	2.626
82.60	3.252
96.00	3.780
97.60	3.843
101.60	4.000
107.20	4.220
109.50	4.311

BATTERY SHALL PASS FREELY THROUGH A
CYLINDRICAL TUBE 82.6 DIAMETER X 101.6 LONG.

Eveready Battery Company, Inc.

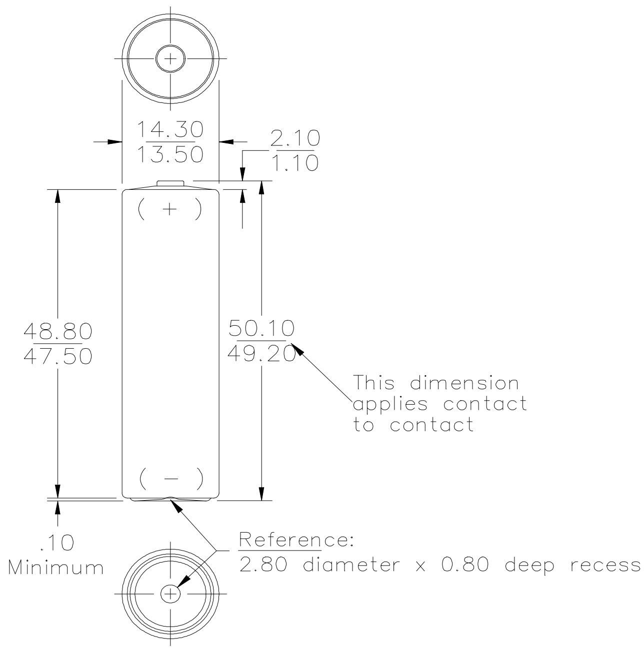
Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

AA
Zinc Chloride ***1.5V***
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

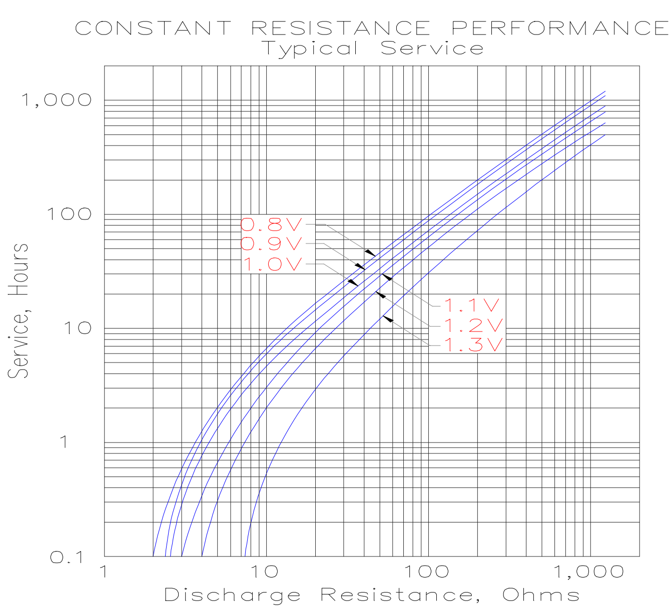
EVEREADY NO. EV15

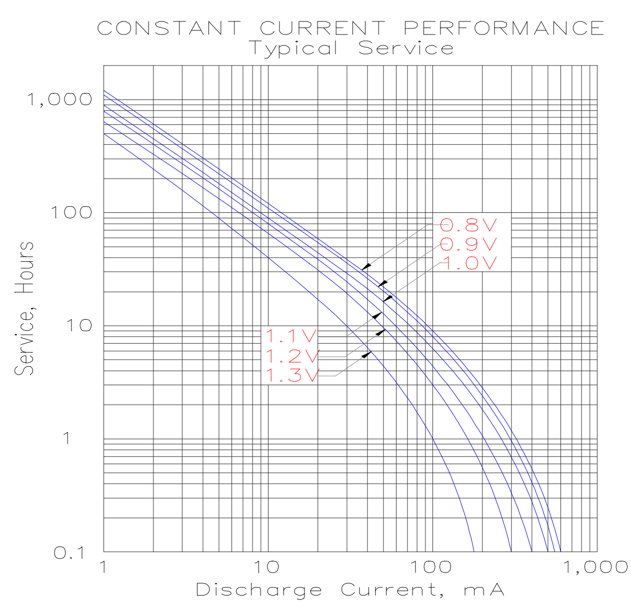
Dimensions (mm)



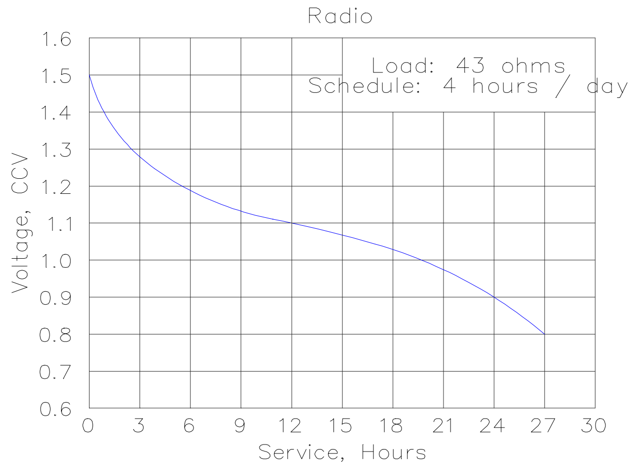
Chemical System:Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI-15C, IEC-LR6
Battery Voltage: 1.5 Volts
Average Weight: 15 grams (0.5oz.)
Volume: 8.0 cubic centimeters (0.5 cubic inch)
Average Service capacity (to 0.8Volts / cell): 1.1 Ah
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 15 (size "AA")
Jacket: Plastic Label

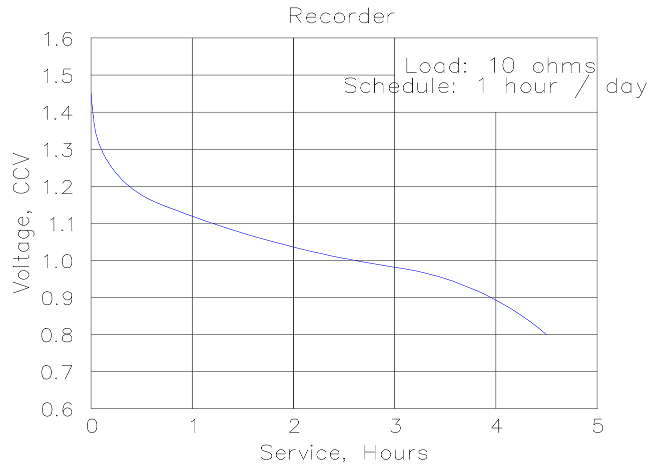
Millimeters	Inches
0.10	0.004
0.80	0.031
1.10	0.043
2.10	0.083
2.80	0.110
13.50	0.531
14.30	0.563
47.50	1.870
48.80	1.921
49.20	1.937
50.10	1.972

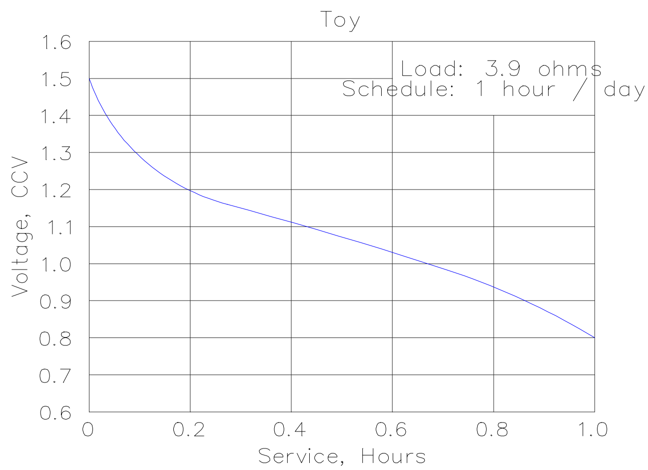


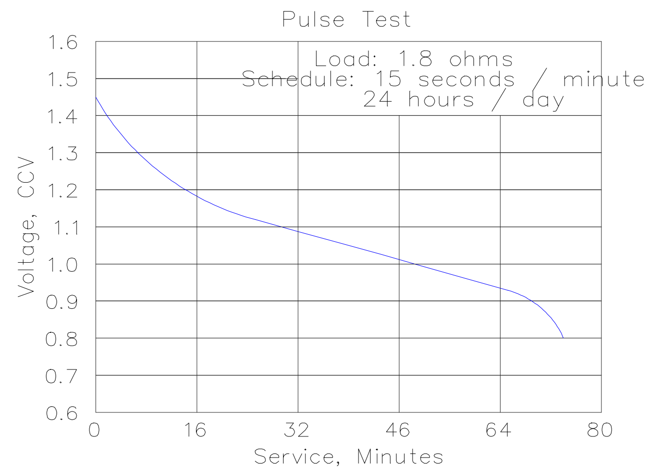


Typical Applications









INTERNAL RESISTANCE VS TEMPERATURE

This measurement is an approximation of the battery's actual internal resistance. It is sensitive to the loads selected and operator technique.

Schedule: Background Load 750 ohms, Pulse Load 4.0 ohms, Pulse Duration 1 second.

Temperature	Typical Ri (ohms)
45°C (113°F)	0.4
21°C (70°F)	0.5
0°C (32°F)	0.8
−20°C (−4°F)	5.0

Important Notice

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Checkerboard Square
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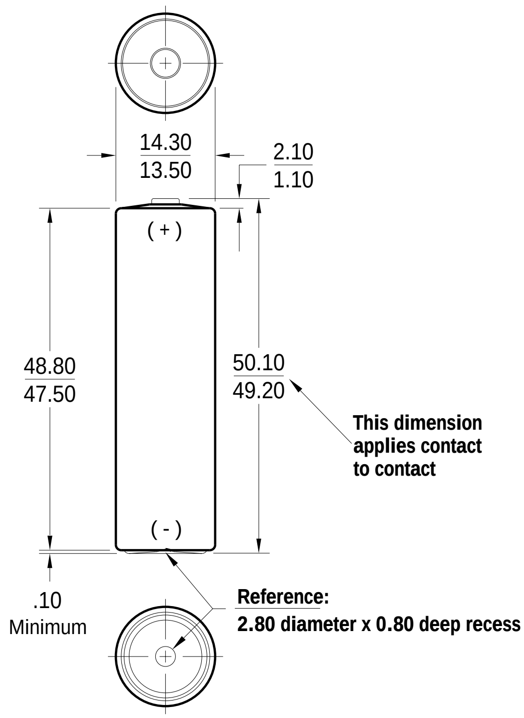
Engineering Data

AA

Zinc Chloride ***1.5V***
Industrial Heavy Duty
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EV115



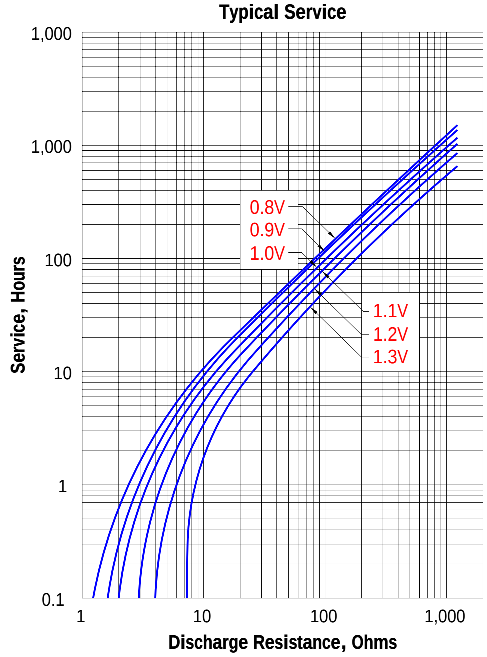
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-15CD, IEC-LR6
Battery Voltage: 1.5 Volts
Average Weight: 15 grams (0.5 oz.)
Volume: 8.0 cubic centimeters (0.5 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 1.4 Ah
(Rated capacity at 25 mA continuous drain)
Cells: One No. 15 (size "AA")
Jacket: Plastic Laminated Paper

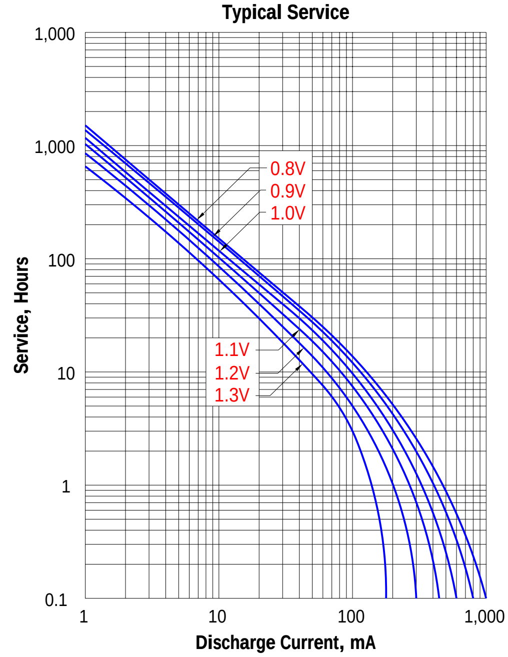
Dimensions (mm)

Millimeters	Inches
.10	.004
.80	.031
1.10	.043
2.10	.083
2.80	.110
13.50	.531
14.30	.563
47.50	1.870
48.80	1.921
49.20	1.937
50.10	1.972

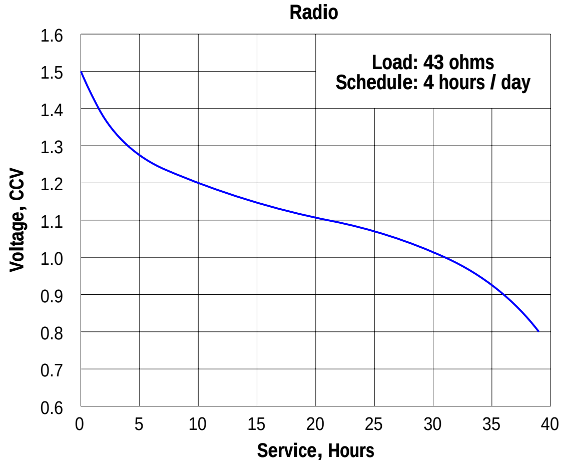
CONSTANT RESISTANCE PERFORMANCE
Typical Service

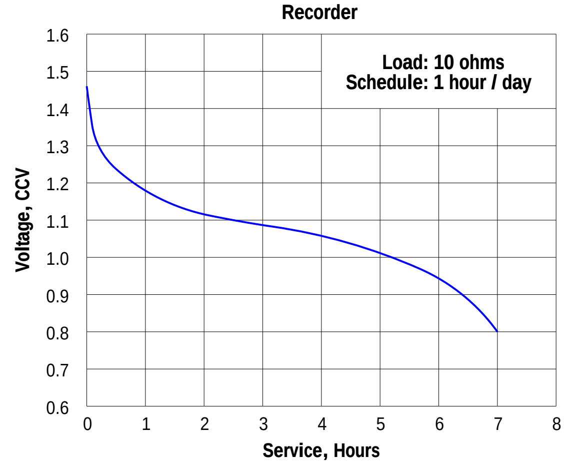


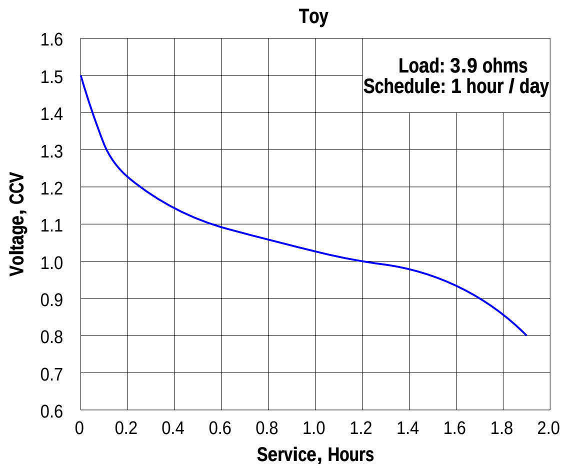
CONSTANT CURRENT PERFORMANCE
Typical Service

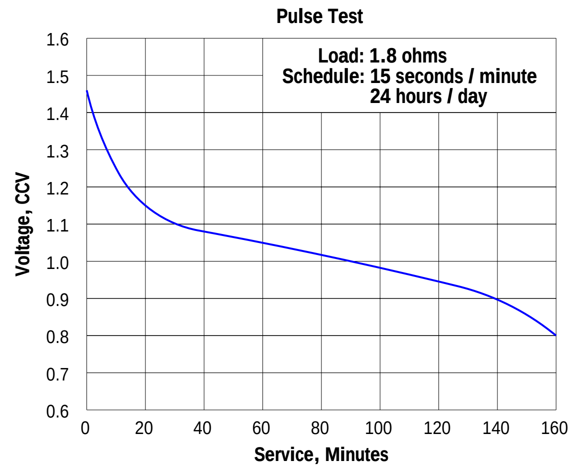


TYPICAL APPLICATIONS









IMPORTANT NOTICE

Eveready Battery Company, Inc.

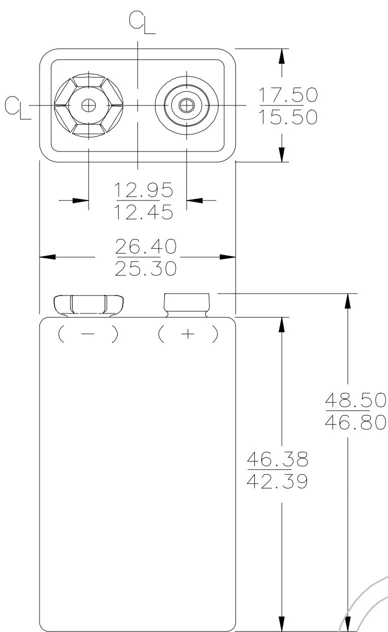
Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

LeClanche **9V**
Industrial General Purpose
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

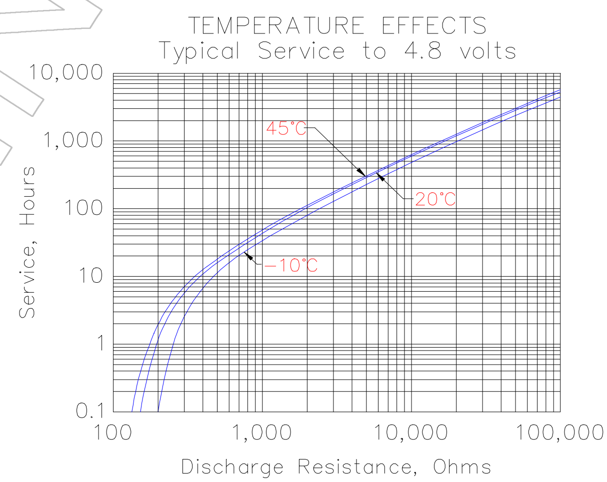
EVEREADY NO. EV22

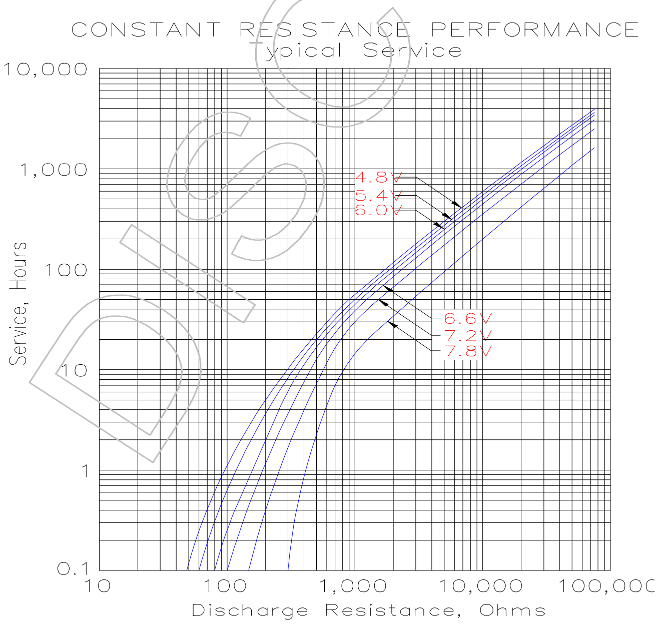
Dimensions (mm)

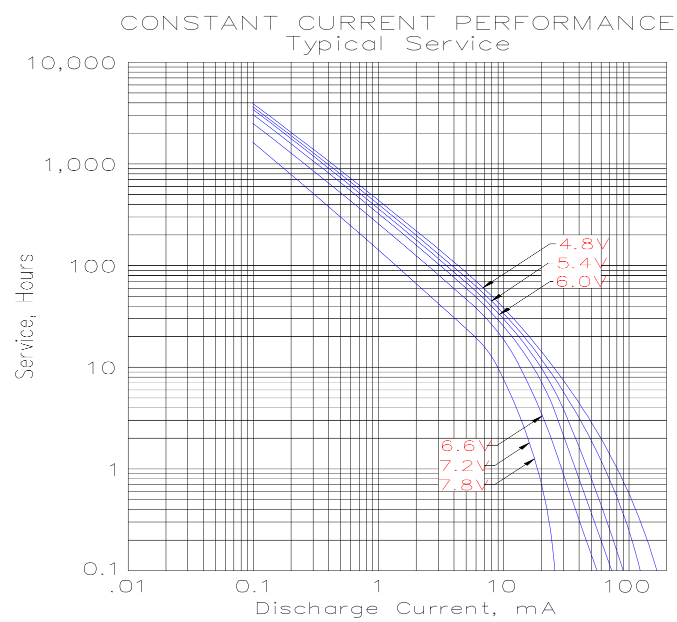


Millimeters	Inches
12.45	0.490
12.95	0.510
15.50	0.610
17.50	0.689
25.30	0.996
26.40	1.039
42.39	1.669
46.38	1.826
46.80	1.843
48.50	1.909

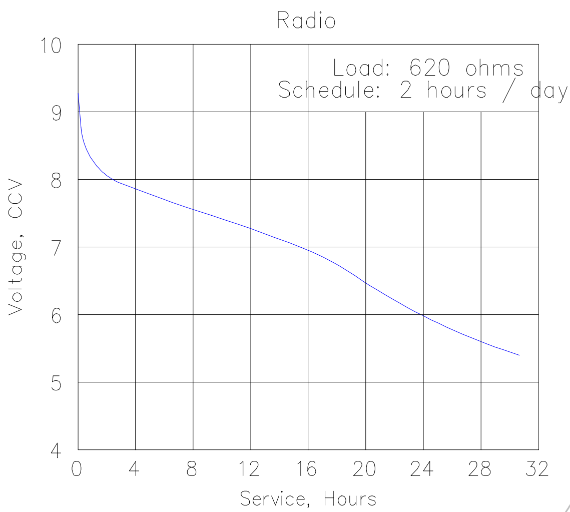
Chemical System:Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI-1604D, IEC-6F22
Battery Voltage: 9 Volts
Average Weight: 36 grams (1.27 oz.)
Volume: 22.4 cubic centimeters (1.37 cubic inch)
Cells: Six No. 118P in series
Jacket: Metal

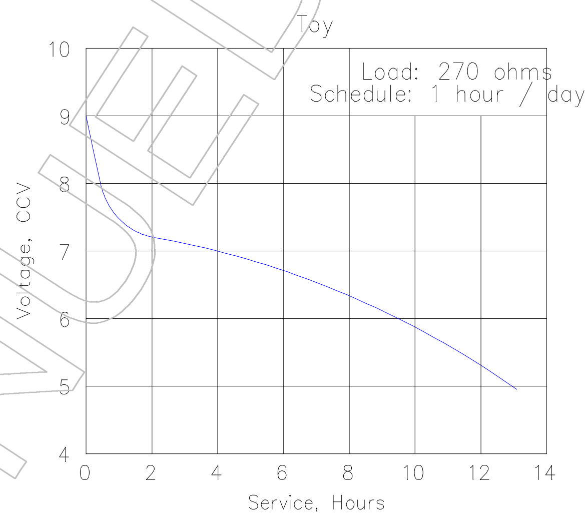


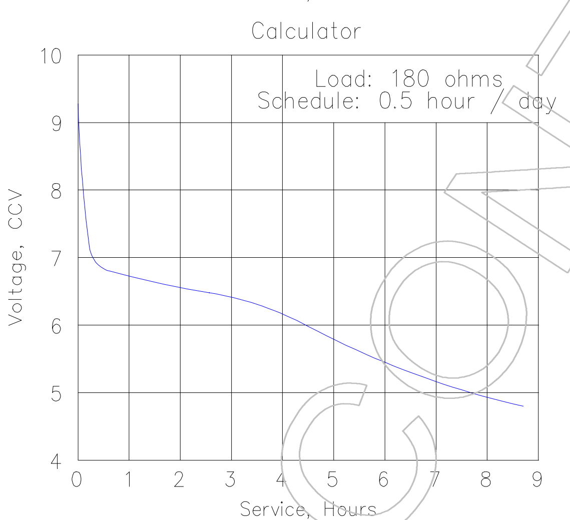


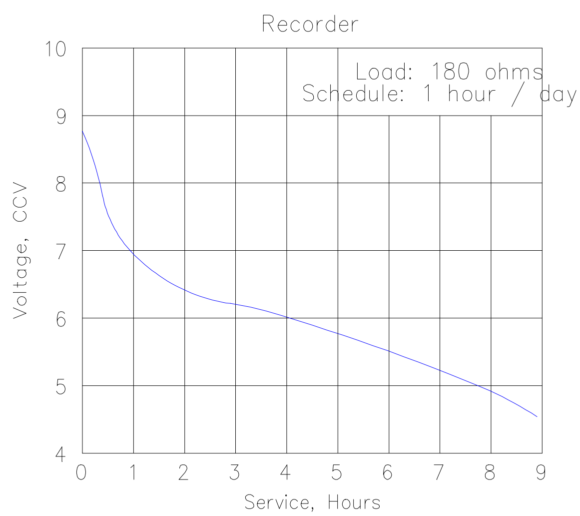


Typical Applications









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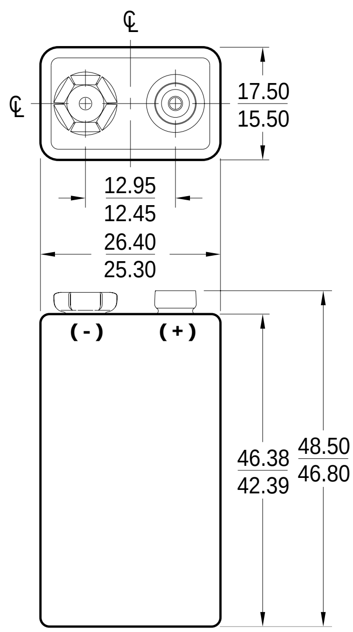
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

EVEREADY NO. EV122

LeClanche ***9V***
Industrial Heavy Duty
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

Dimensions (mm)

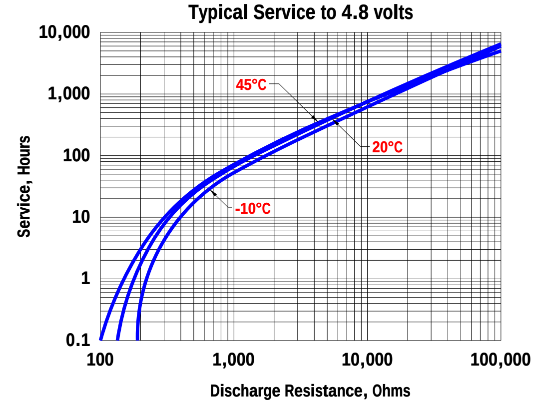


Millimeters	Inches
12.45	.490
12.95	.510
15.50	.610
17.50	.689
25.30	.996
26.40	1.039
42.39	1.669
46.38	1.826
46.80	1.843
48.50	1.909

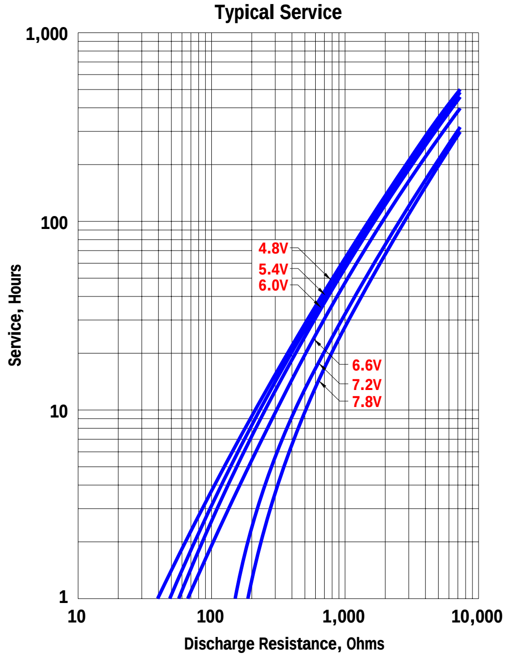
Chemical System: Zinc-Manganese Dioxide ($Zn/Mn0_2$)

Designation: ANSI-1604D, IEC-6F22
Battery Voltage: 9 Volts
Average Weight: 37 grams (1.3 oz.)
Volume: 20.3 cubic centimeters (1.2 cubic inch)
Cells: Six No. 118P in series
Jacket: Metal

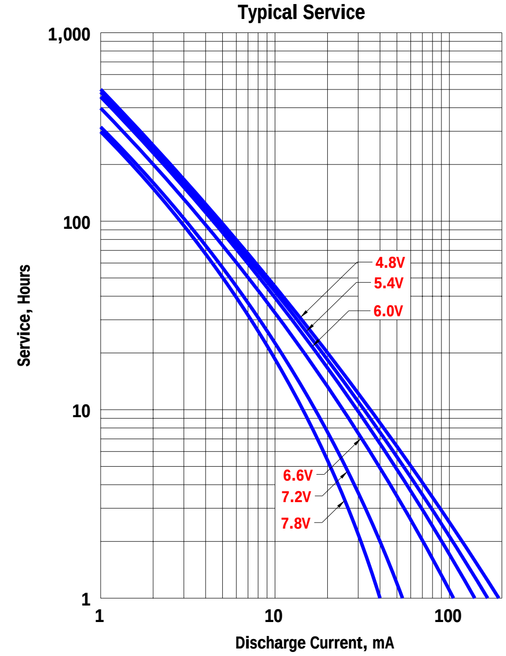
TEMPERATURE EFFECTS
Typical Service to 4.8 volts



CONSTANT RESISTANCE PERFORMANCE
Typical Service

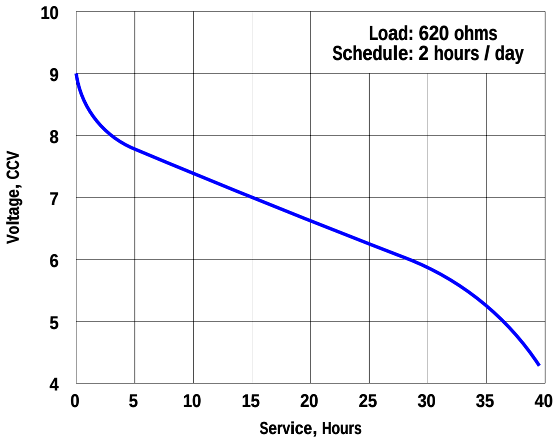


CONSTANT CURRENT PERFORMANCE
Typical Service

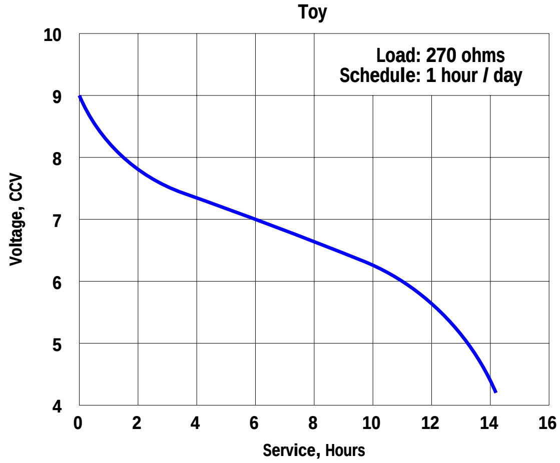


TYPICAL APPLICATIONS

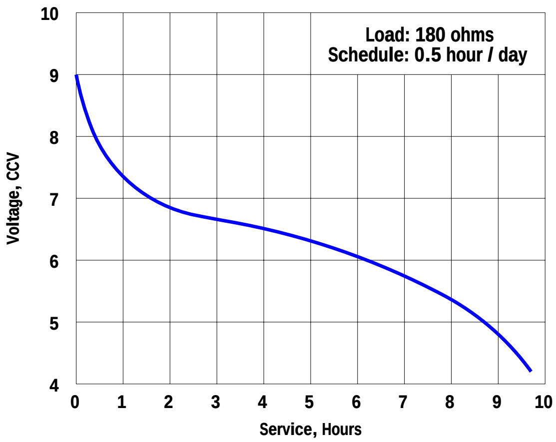
Radio



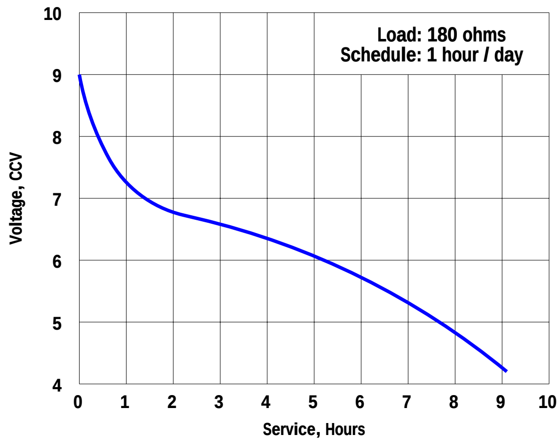
Toy



Calculator



Recorder



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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

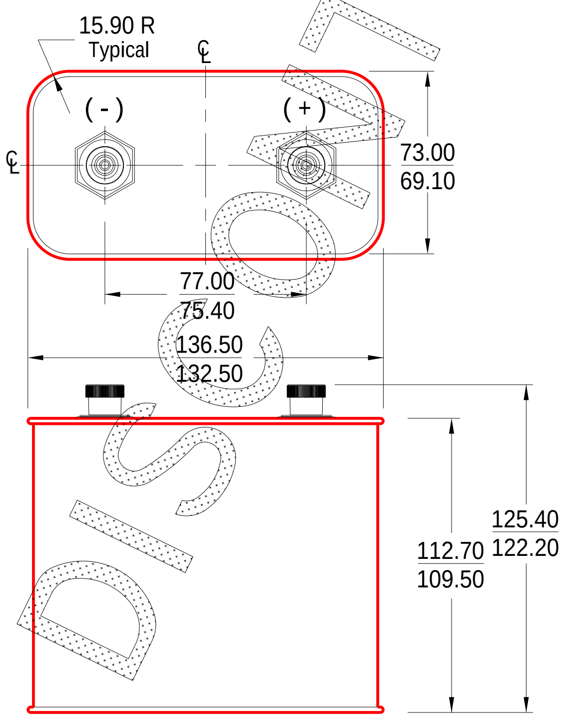
EVEREADY NO. EV31

Zinc Chloride ***6V***
General Purpose
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI / NEDA-918, IEC-4R25-2
Battery Voltage: 6 Volts
Average Weight: 1.25 kilograms (44.1 oz.)
Volume: 1123 cubic centimeters (68.5 cubic inch)
Cells: Eight No. 60 (size "F")-Two parallel strings of four in series.
Jacket: Metal

Dimensions (mm)



Millimeters	Inches
15.90	.626
69.10	2.720
73.00	2.874
75.40	2.969
77.00	3.031
109.50	4.311
112.70	4.437
122.20	4.811
125.40	4.937
132.50	5.217
136.50	5.374

Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

C

Zinc Chloride ***1.5V***

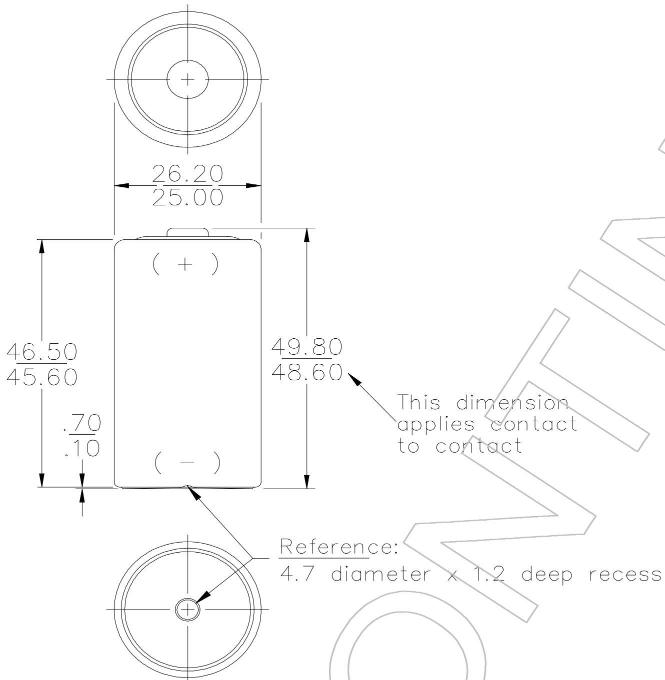
Industrial General Purpose

No Added Mercury or Cadmium

NOT INTENDED FOR RETAIL TRADE

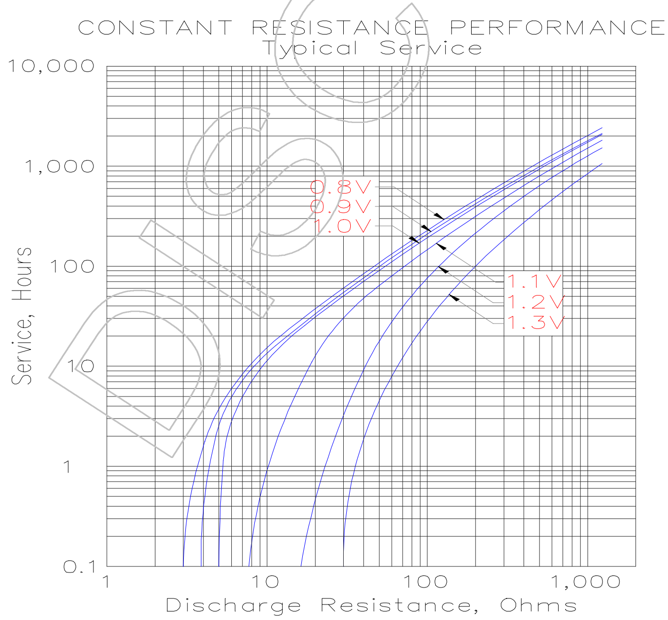
EVEREADY NO. EV35

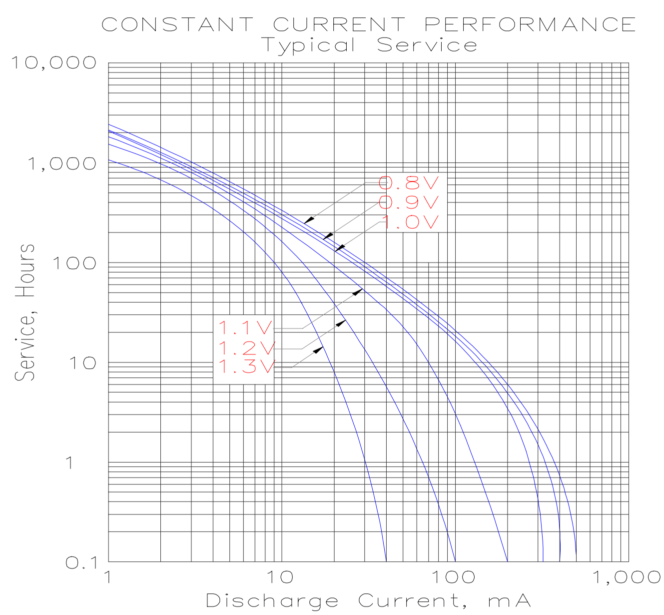
Dimensions (mm)



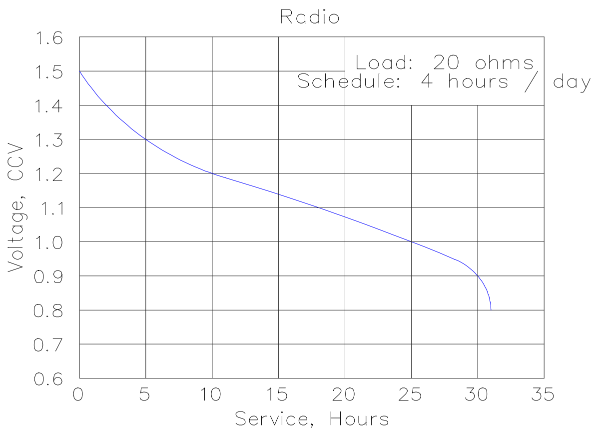
Chemical System:Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI-14C, IEC-R14
Battery Voltage: 1.5 Volts
Average Weight: 41 grams (1.5 oz.)
Volume: 25.0 cubic centimeters (1.5 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 2.9 Ah
(Rated capacity at 25 mA continuous drain)
Cells: One No. 35 (size "C")
Jacket: Plastic Laminated Paperl

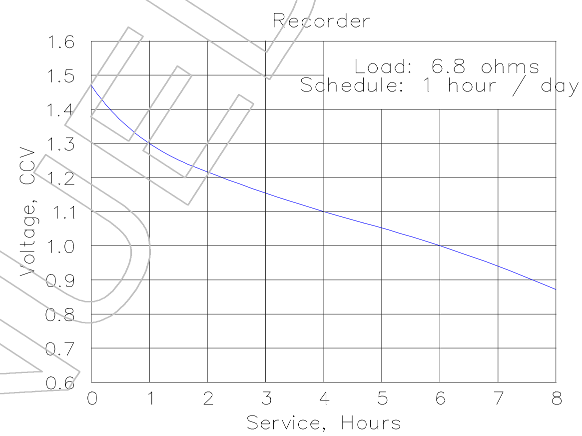
Millimeters	Inches
0.10	0.004
0.70	0.028
1.20	0.047
4.70	0.185
25.00	0.984
26.20	1.031
45.60	1.795
16.50	0.650
48.60	1.913
49.80	1.961

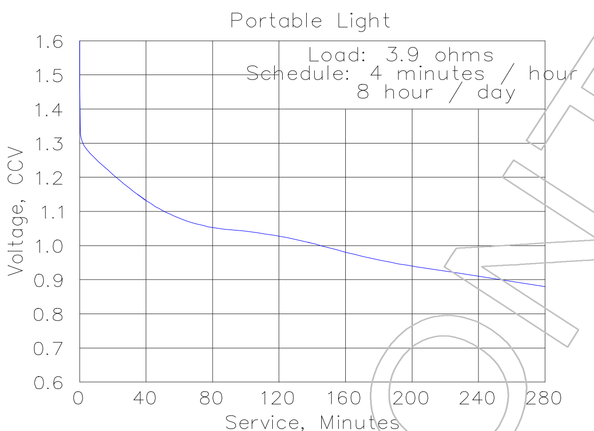


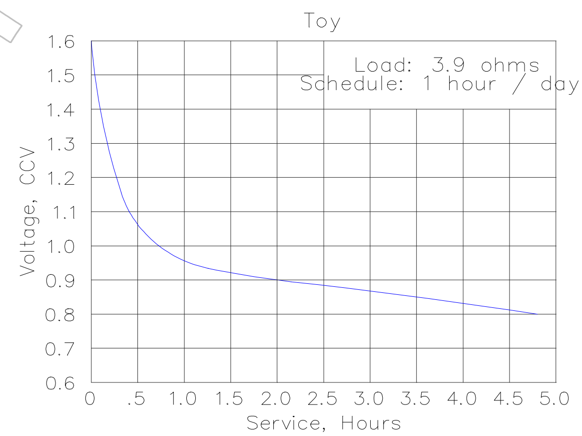


Typical Applications









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Checkerboard Square
St. Louis, MO 63164
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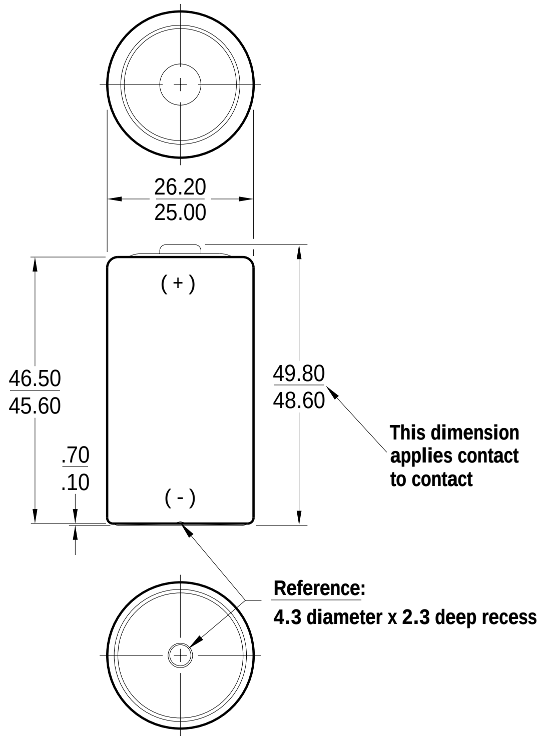
Engineering Data

C

Zinc Chloride ***1.5V***
Industrial Heavy Duty
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EV135



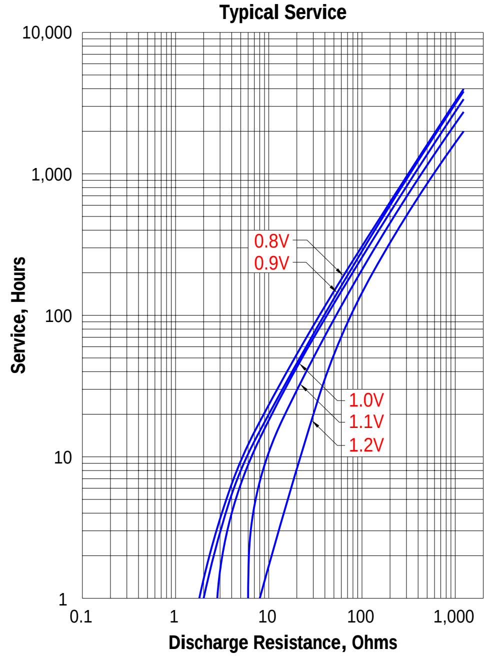
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-14CD, IEC-R14
Battery Voltage: 1.5 Volts
Average Weight: 45 grams (1.6 oz.)
Volume: 25 cubic centimeters (1.5 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 3.1 Ah
(Rated capacity at 25 mA continuous drain)
Cells: One No. 35 (size "C")
Jacket: Plastic Laminated Paper

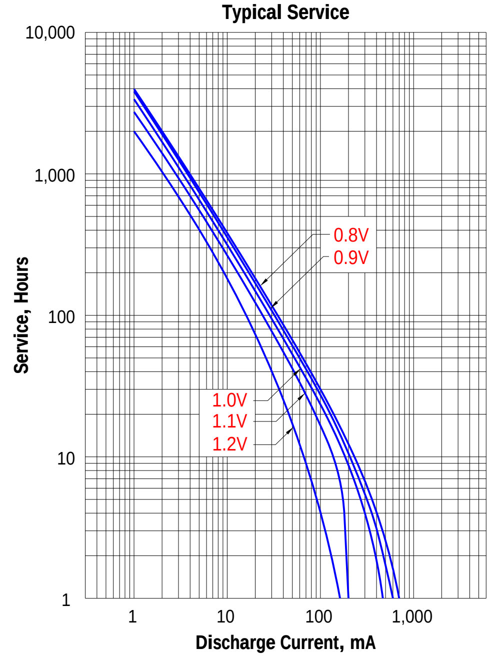
Dimensions (mm)

Millimeters	Inches
.10	.004
.70	.028
2.30	.091
4.30	.169
25.00	.984
26.20	1.031
45.60	1.795
46.50	1.831
48.60	1.913
49.80	1.961

CONSTANT RESISTANCE PERFORMANCE
Typical Service

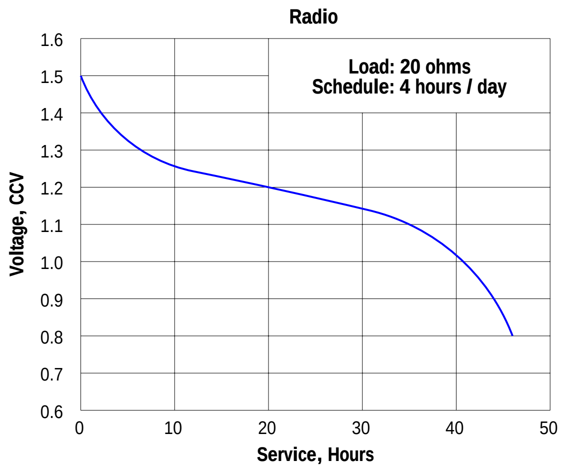


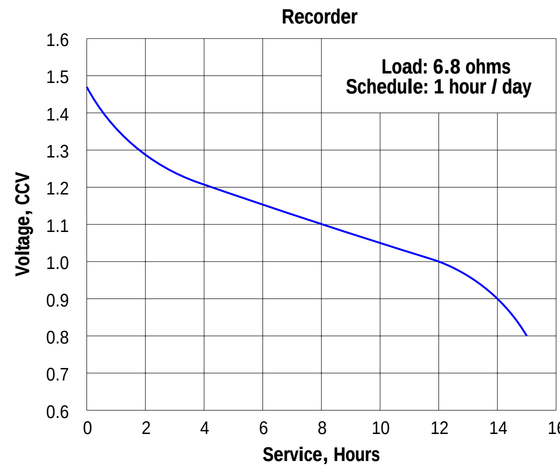
CONSTANT CURRENT PERFORMANCE
Typical Service

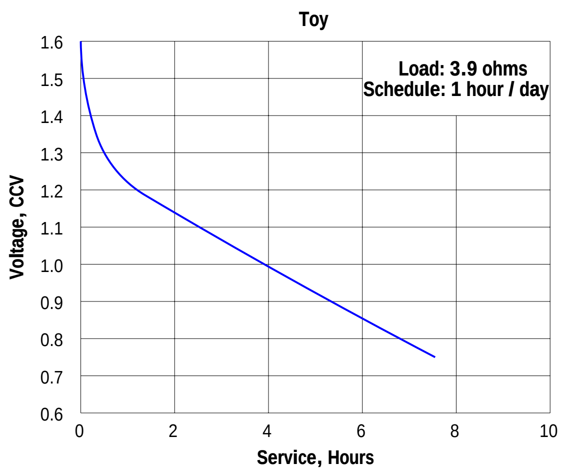


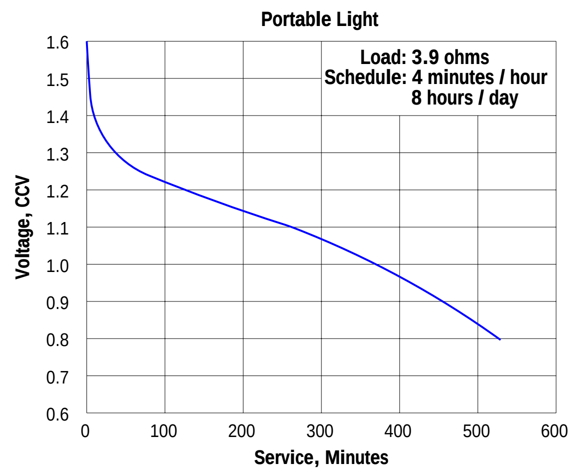
EVEREADY NO. EV135

TYPICAL APPLICATIONS









IMPORTANT NOTICE

Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

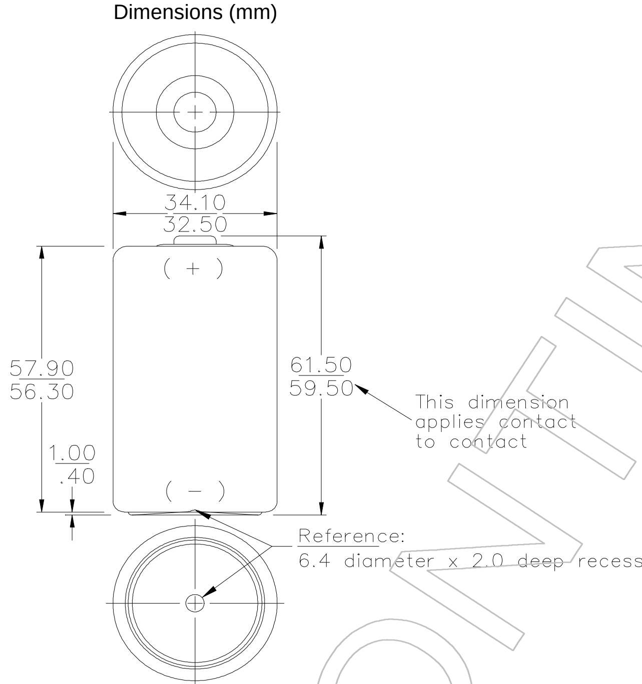
D

Zinc Chloride ***1.5V***
Industrial General Purpose
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

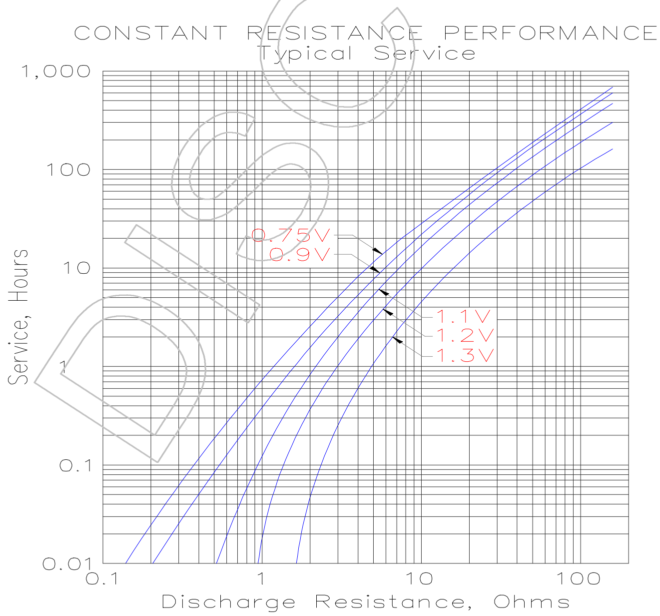
EVEREADY NO. EV50

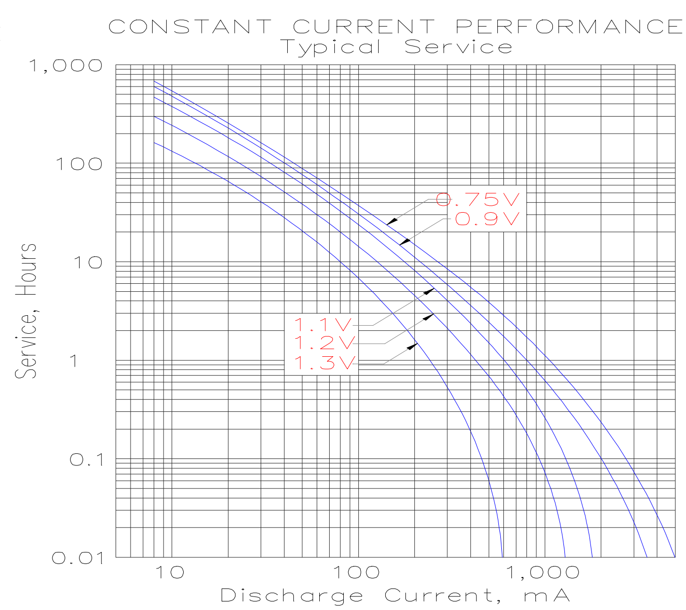
Chemical System:Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI-13C, IEC-R20
Battery Voltage: 1.5 Volts
Average Weight: 81 grams (2.9 oz.)
Volume: 53.0 cubic centimeters (3.2 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 4.5 Ah
(Rated capacity at 25 mA continuous drain)
Cells: One No. 50 (size "D")
Jacket: Plastic Laminated Paper

Dimensions (mm)

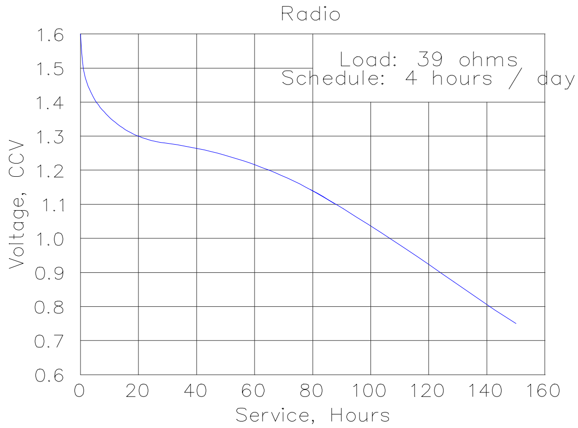


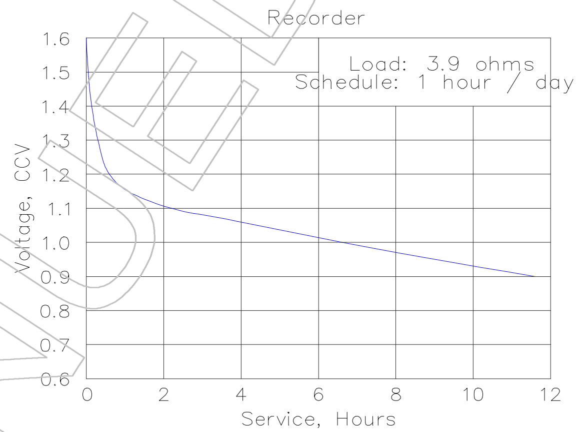
Millimeters	Inches
0.40	0.016
1.00	0.039
2.00	0.079
6.40	0.252
32.50	1.280
34.10	1.343
56.30	2.217
57.90	2.280
59.50	2.343
61.50	2.421

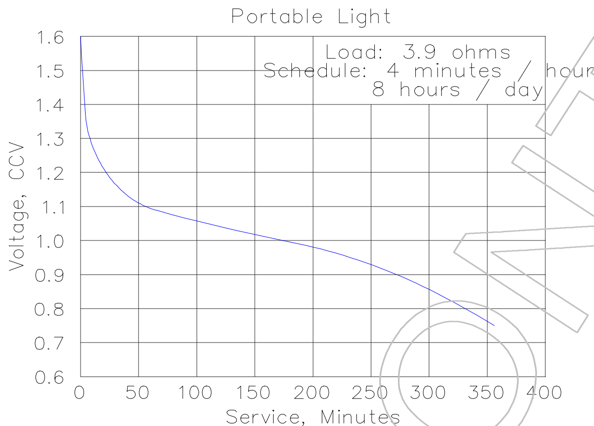




Typical Applications







Important Notice

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

D

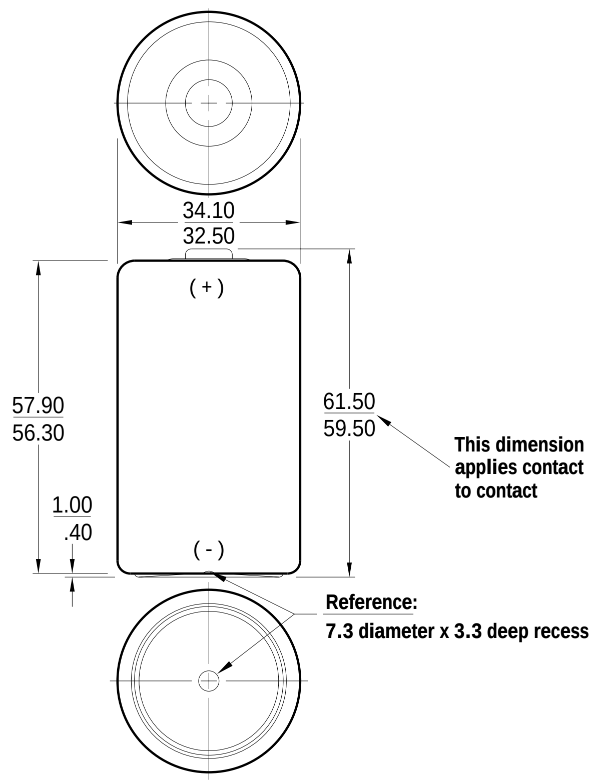
Zinc Chloride ***1.5V***

Industrial Heavy Duty

No Added Mercury or Cadmium

NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EV150



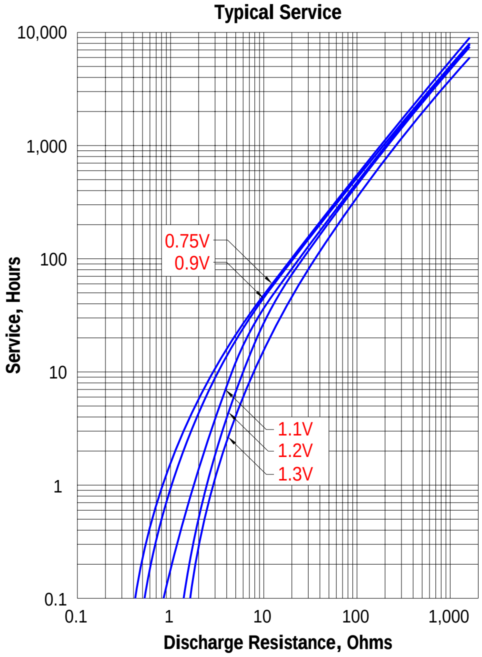
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-13CD, IEC-R20
Battery Voltage: 1.5 Volts
Average Weight: 89 grams (3.1 oz.)
Volume: 53 cubic centimeters (3.2 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 6.1 Ah
(Rated capacity at 25 mA continuous drain)
Cells: One No. 50 (size "D")
Jacket: Plastic Laminated Paper

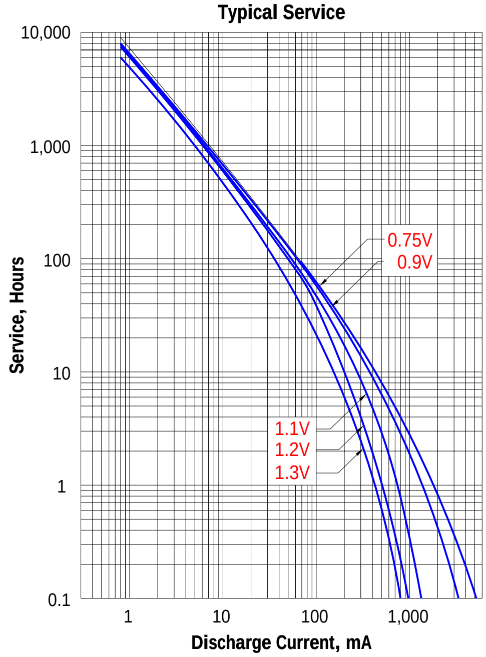
Dimensions (mm)

Millimeters	Inches
.40	.016
1.00	.039
3.30	.130
7.30	.287
32.50	1.280
34.10	1.343
56.30	2.217
57.90	2.280
59.50	2.343
61.50	2.421

CONSTANT RESISTANCE PERFORMANCE
Typical Service

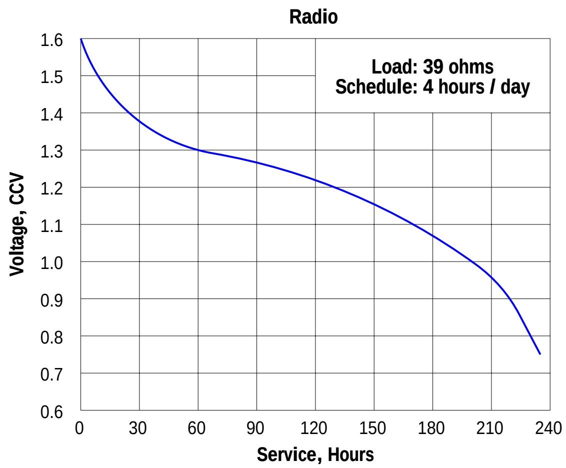


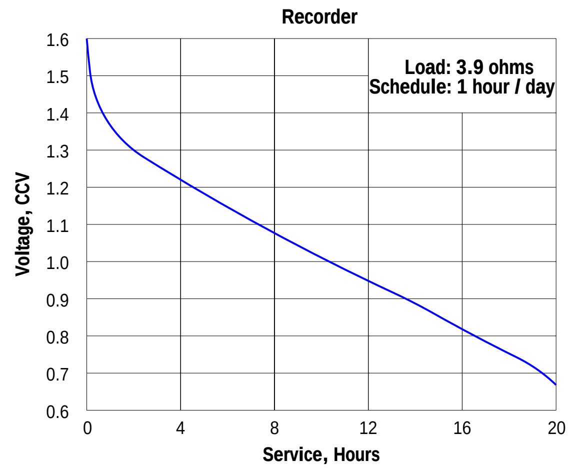
CONSTANT CURRENT PERFORMANCE
Typical Service

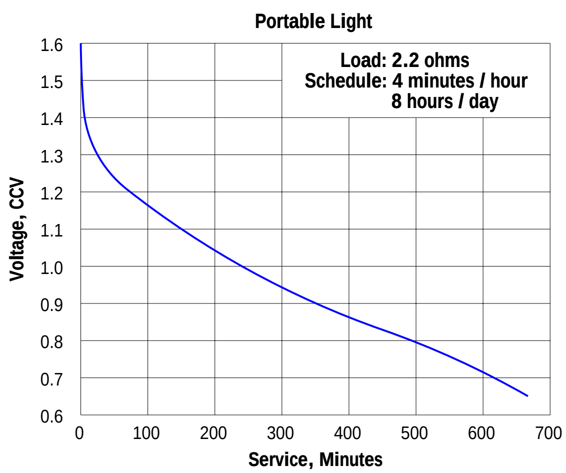


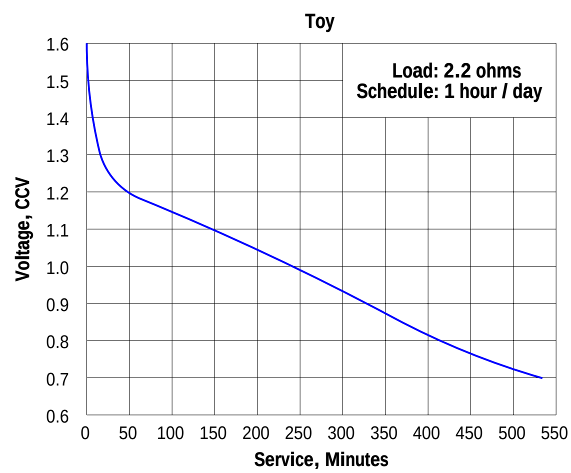
EVEREADY NO. EV150

TYPICAL APPLICATIONS









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Eveready Battery Company, Inc.

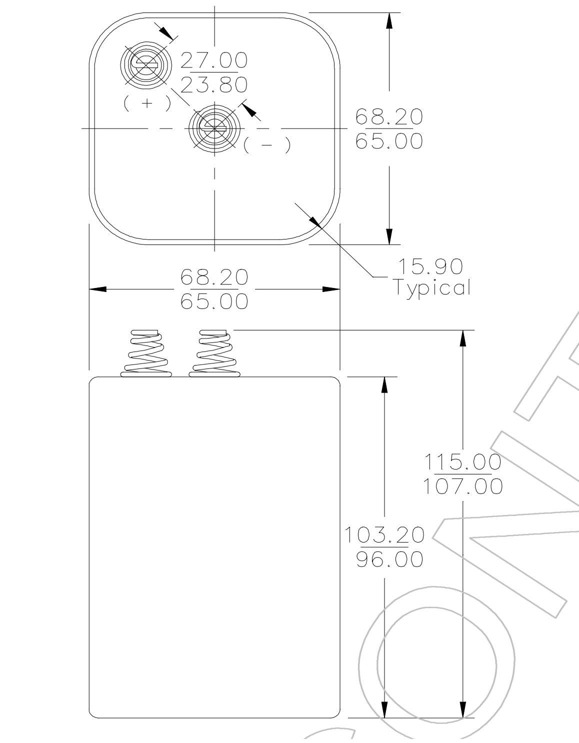
Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Zinc Chloride ***6V***
Industrial General Purpose
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EV90

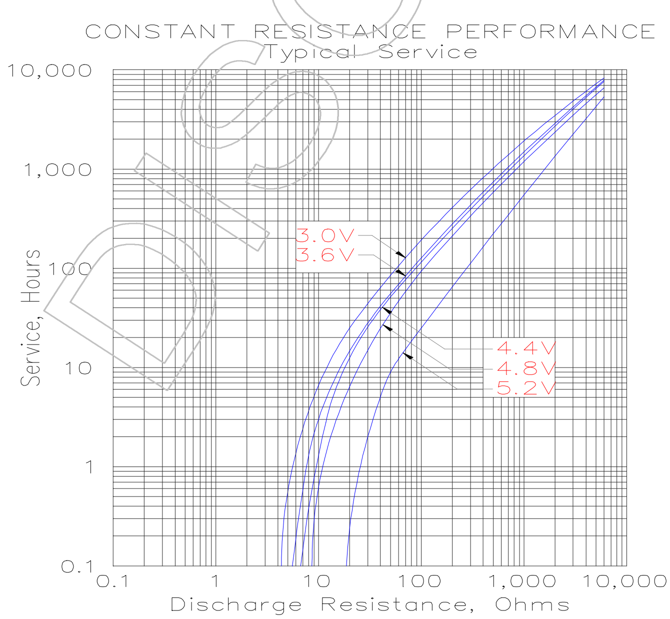
Dimensions (mm)

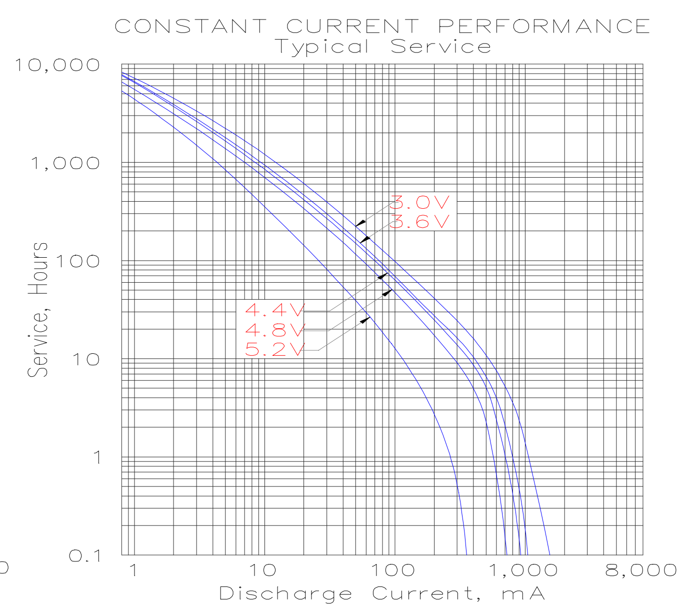


THIS BATTERY SHALL PASS FREELY THROUGH A CYLINDRICAL TUBE 82.6 DIAMETER X 101.6 LONG.

Chemical System:Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI-908C, IEC-4R25
Battery Voltage: 6.0 Volts
Average Weight: 600 grams (21.2 oz.)
Volume: 492 cubic centimeters (30 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 10 Ah
(Rated capacity at 25 mA continuous drain)
Cells: Four No. 60 (size "F") in series
Jacket: Plastic

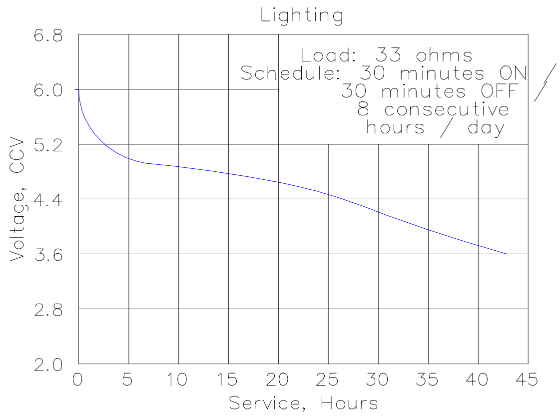
Millimeters	Inches
15.90	0.626
23.00	0.906
27.00	1.063
65.00	2.559
68.20	2.685
82.60	3.252
96.00	3.780
101.60	4.000
103.20	4.063
107.00	4.213
115.00	4.528

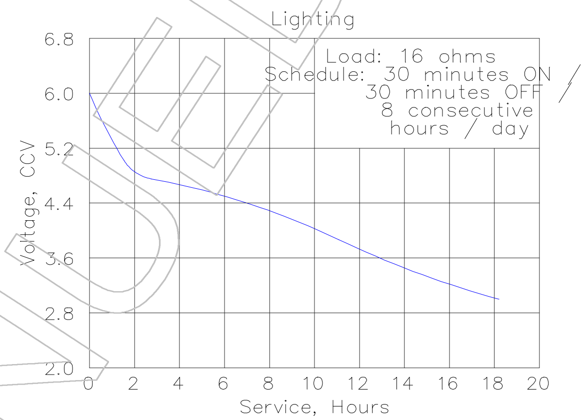


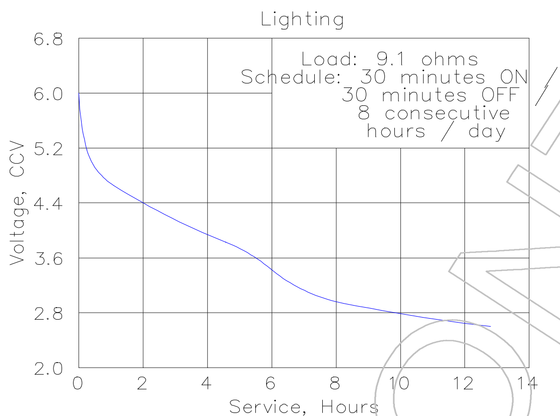


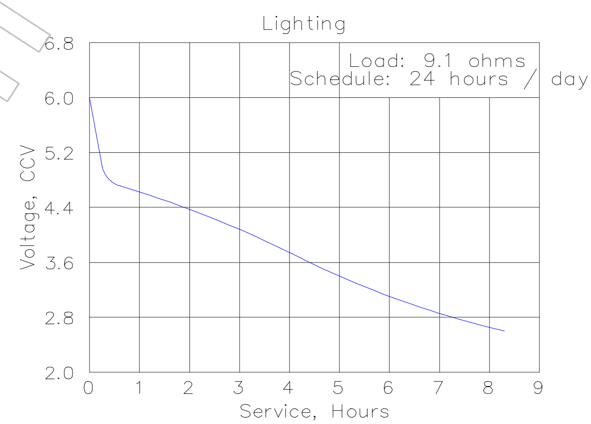
Form No. EBC - 3205B

Typical Applications









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Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

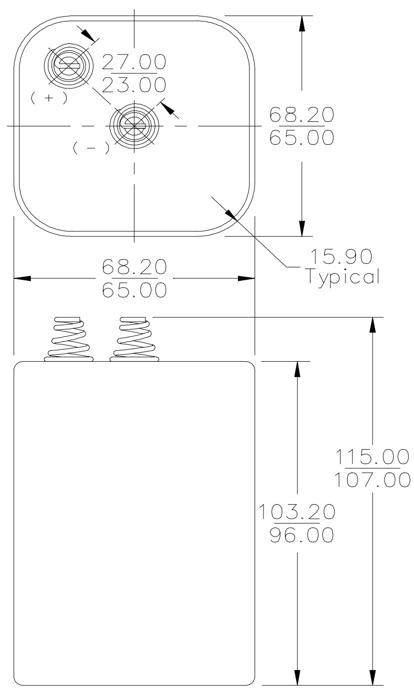
Engineering Data

Zinc Chloride ***6V***
Industrial Heavy Duty
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

Chemical System:Zinc-Manganese Dioxide (Zn/MnO_2)

EVEREADY NO. EV190

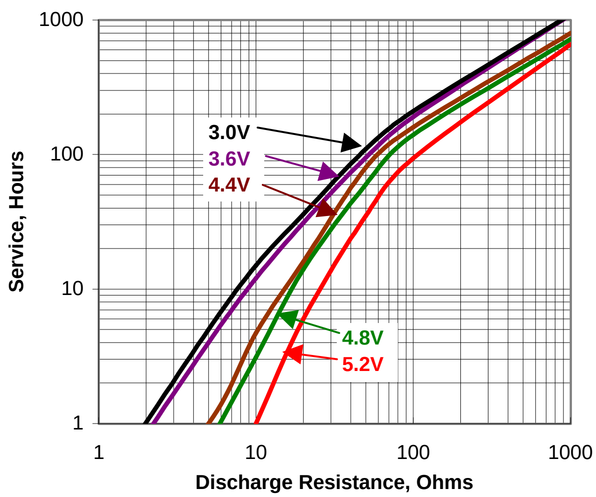
Dimensions (mm)



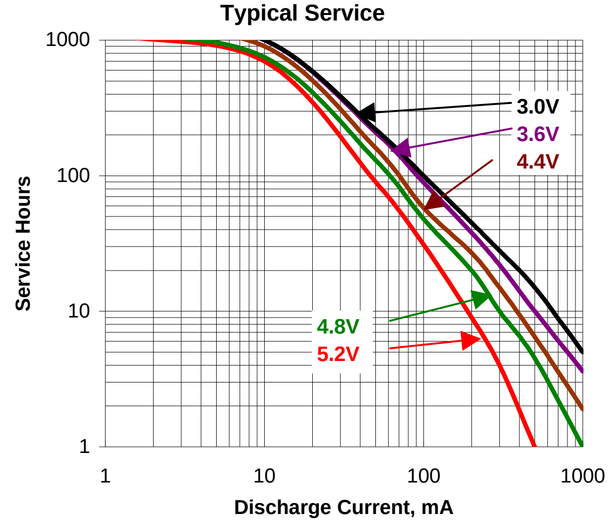
Designation: ANSI-908CD, IEC-4R25X
Battery Voltage: 6 Volts
Average Weight: 589 grams (20.8 oz.)
Volume: 480 cubic centimeters (29.2 cubic inch)
Average Service capacity (to 0.8Volts / cell): 11 Ah
(Rated Capacity at 25 mA continuous drain)
Cell: Four No. 60 (size "F") in series
Jacket: Plastic

Millimeters	Inches
15.90	0.626
23.00	0.906
27.00	1.063
65.00	2.559
68.20	2.685
82.60	3.252
96.00	3.780
101.60	4.000
103.20	4.063
107.00	4.213
115.00	4.528

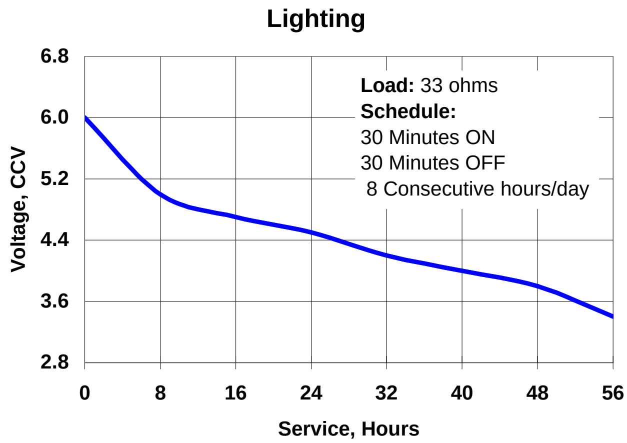
CONSTANT RESISTANCE PERFORMANCE
Typical Service

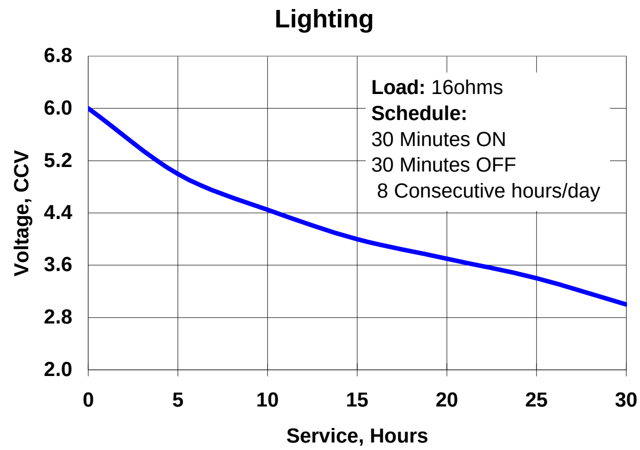


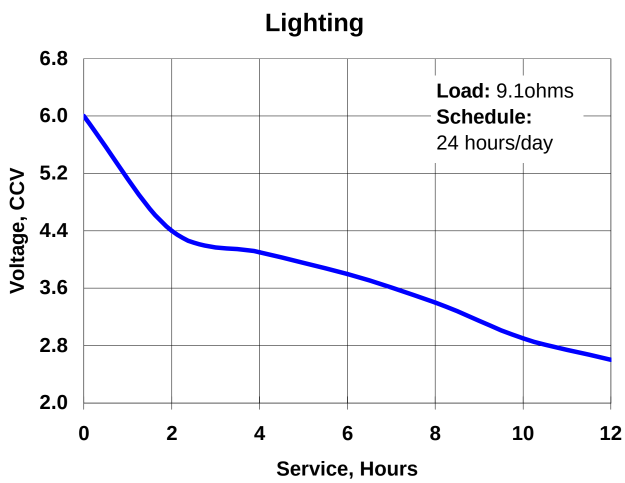
CONSTANT RESISTANCE PERFORMANCE
Typical Service

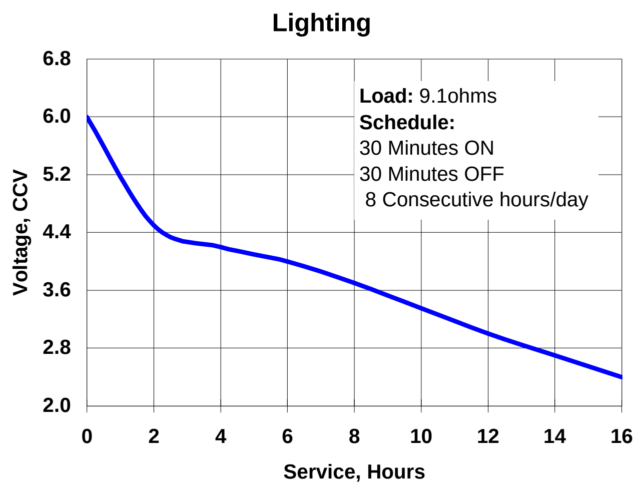


Typical Applications









INTERNAL RESISTANCE VS. TEMPERATURE
This measurement is an approximation of the battery's actual internal resistance. It is sensitive to the loads and operator technique.

Schedule: Background Load 600 ohms.
Pulse Load 10 ohms.
Pulse Duration 1 second

Temperature	Typical Ri (ohms)
45ºC (113ºF)	0.7
21ºC (70ºF)	0.9
0ºC (32ºF)	1
-21ºC (-4ºF)	10

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Eveready Battery Company, Inc.

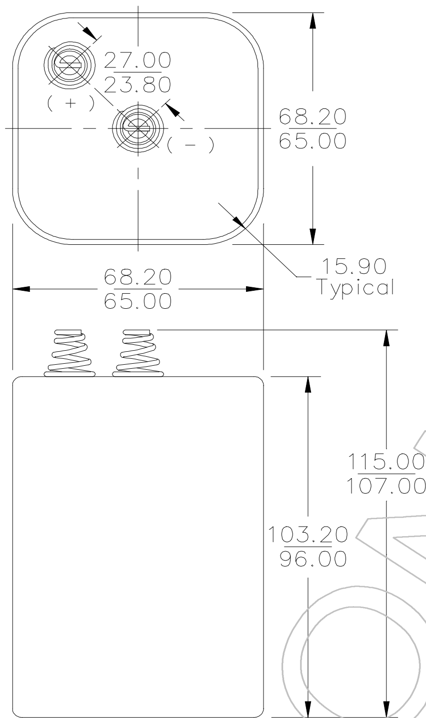
Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Zinc Chloride ***6V***
Industrial General Purpose
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

EVEREADY NO. EV90HP

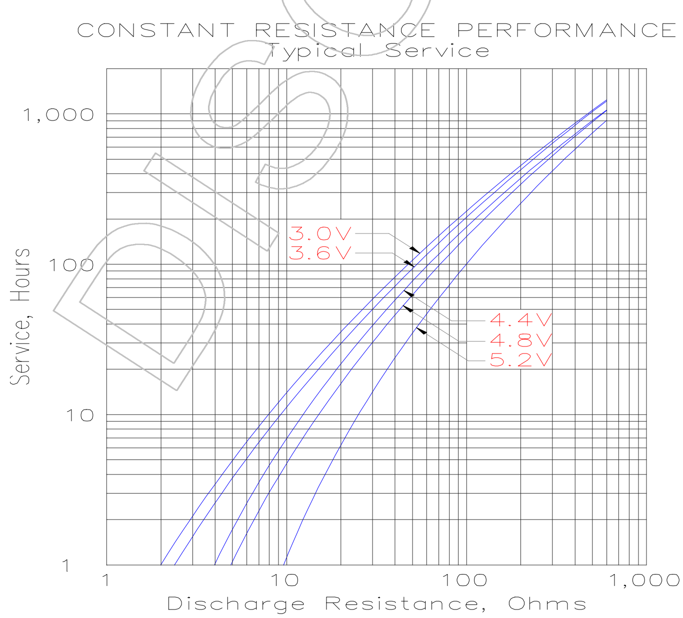
Dimensions (mm)

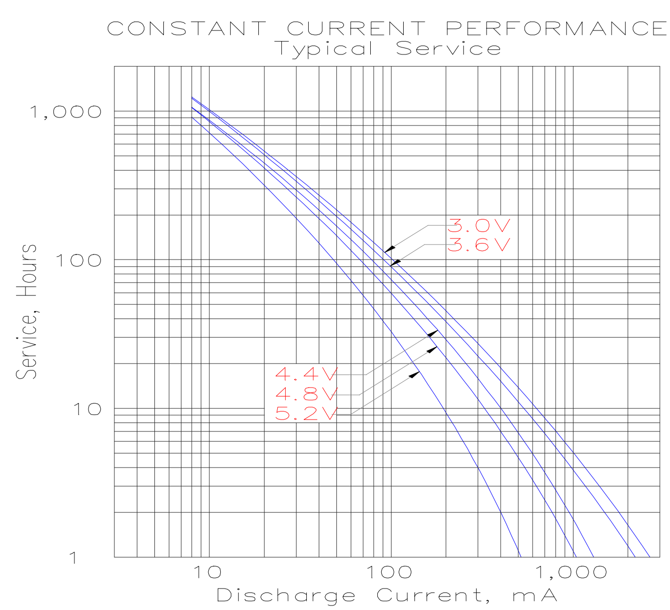


THIS BATTERY SHALL PASS FREELY THROUGH A CYLINDRICAL TUBE 82.6 DIAMETER X 101.6 LONG.

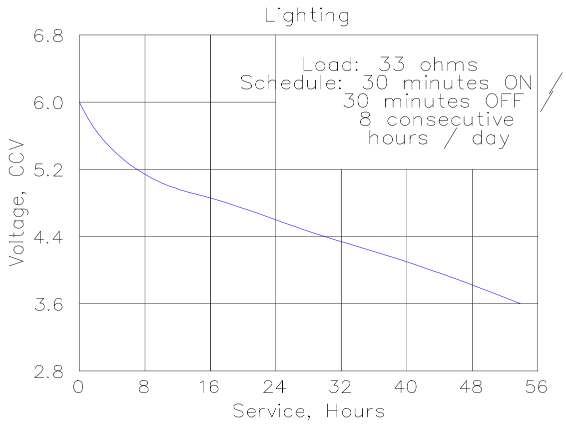
Chemical System:Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI-908C, IEC-4R25
Battery Voltage: 6.0 Volts
Average Weight: 600 grams (21.2 oz.)
Volume: 492 cubic centimeters (30 cubic inch)
Average Service Capacity (to 0.8 Volt / cell): 11 Ah
(Rated capacity at 25 mA continuous drain)
Cells: Four No. 60 (size "F") in series
Jacket: Plastic

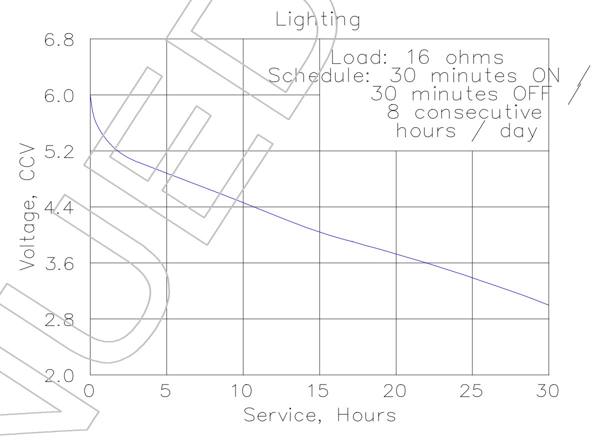
Millimeters	Inches
15.90	0.626
23.00	0.906
27.00	1.063
65.00	2.559
68.20	2.685
82.60	3.252
96.00	3.780
101.60	4.000
103.20	4.063
107.00	4.213
115.00	4.528

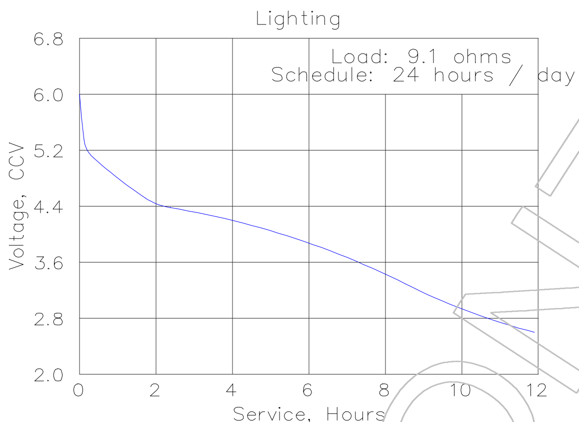


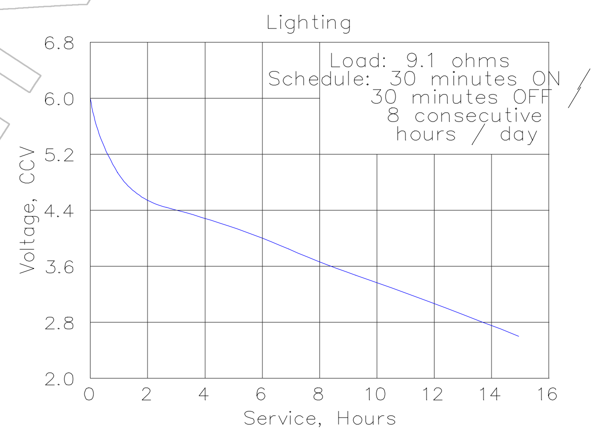


Typical Applications









INTERNAL RESISTANCE VS. TEMPERATURE
This measurement is an approximation of the battery's actual internal resistance. It is sensitive to the loads and operator technique.

Schedule: Background Load 600 ohms.
Pulse Load 10 ohms.
Pulse Duration 1 second

Temperature	Typical Ri (ohms)
45ºC (113ºF)	0.7
21ºC (70ºF)	0.9
0ºC (32ºF)	1.0
-21ºC (-4ºF)	10.0

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Energizer

Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

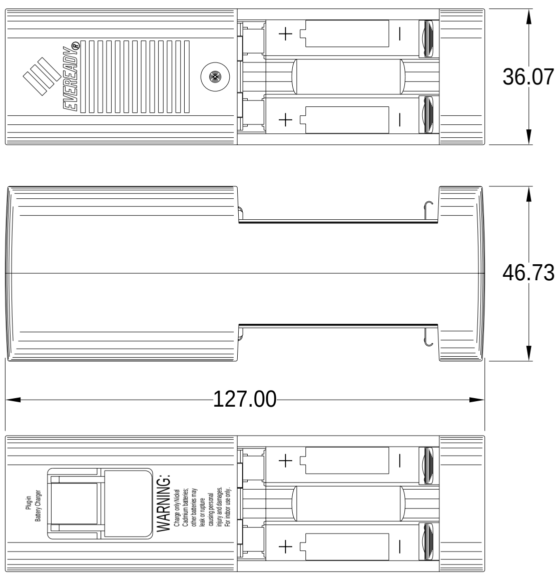
Engineering Data

ENERGIZER MODEL NO. FCC2

Battery Charger

LISTED UL 2E50

Designation: Nickel Cadmium Battery Charger
Five Hour Quick Charging
Charge Output: "AA" 110 mA @ 120 VAC
"AAA" 36 mA @ 120 VAC
Charge Capability: One to four "AA" or "AAA"
Charging Time: 5 hours for "AA" or "AAA"
Typical Weight: 156.7 grams (5.5 oz.)
Feature: LED "POWER ON" Indicator
Plug-in Unit



Dimensions (mm)

Millimeters	Inches
36.07	1.420
46.23	1.820
127.00	5.000

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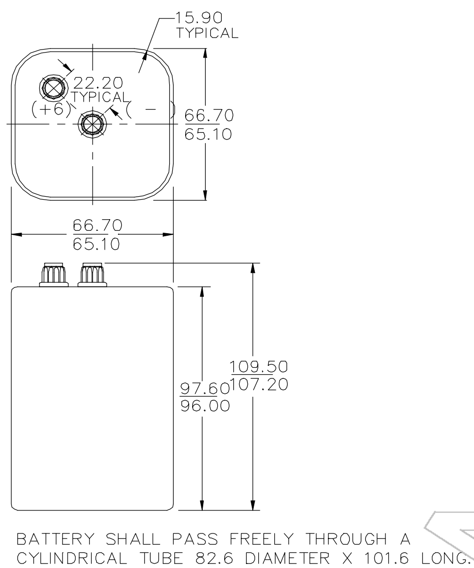
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. HS10S



Chemical System: LeClanche
Designation: ANSI / NEDA-908, IEC-4R25
Typical Weight: 653 grams (23 oz.)
Volume: 434 cubic centimeters (26.5 cubic in.)
Terminals: Plastic Knurl / Screw Post
Cells: Four N. 60 (size "F") in series
Jacket: Metal

Dimensions (mm)

Millimeters	Inches
15.90	0.626
22.20	0.874
65.10	2.563
66.70	2.626
82.60	3.252
96.00	3.780
97.60	3.843
101.60	4.000
107.20	4.220
109.50	4.311

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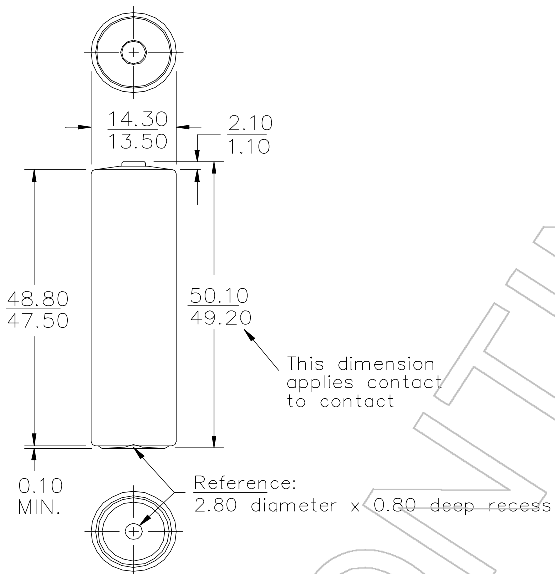
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. HS15



Chemical System: Zinc Chloride
Designation: ANSI / NEDA-15F, IEC-R6
Typical Weight: 15 grams (0.5 oz.)
Volume: 8.0 cubic centimeters (0.5 cubic in.)
Terminals: Plastic Knurl / Screw Post
Cells: One No. 15 (size "AA")

Dimensions (mm)

Millimeters	Inches
0.10	0.004
0.80	0.031
1.10	0.043
2.10	0.083
2.80	0.110
13.50	0.531
14.30	0.563
47.50	1.870
48.80	1.921
49.20	1.937
50.10	1.972

IMPORTANT NOTICE

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Eveready Battery Company, Inc.

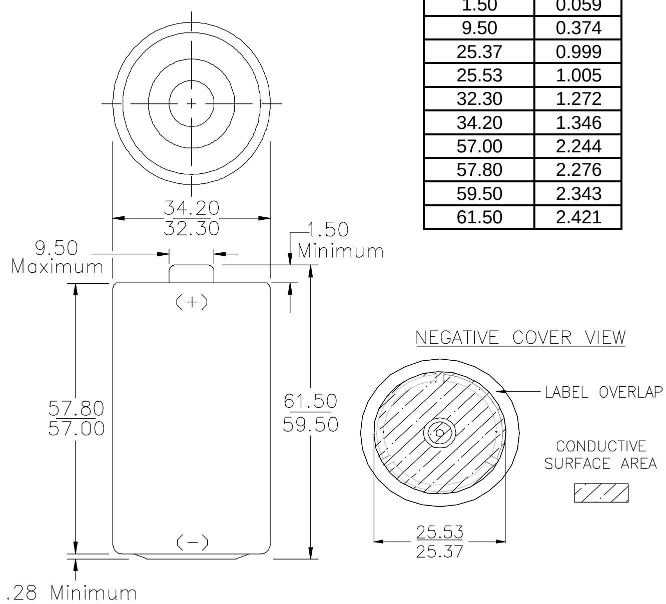
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

D
Alkaline **1.5V**
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

ENERGIZER NO. EN95

Dimensions (mm)

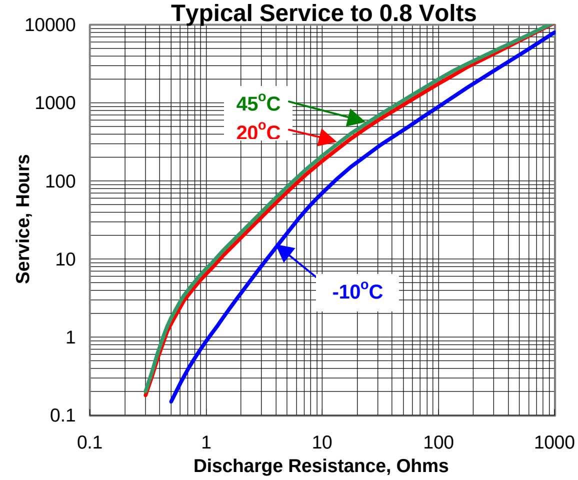


Millimeters	Inches
0.28	0.011
1.50	0.059
9.50	0.374
25.37	0.999
25.53	1.005
32.30	1.272
34.20	1.346
57.00	2.244
57.80	2.276
59.50	2.343
61.50	2.421

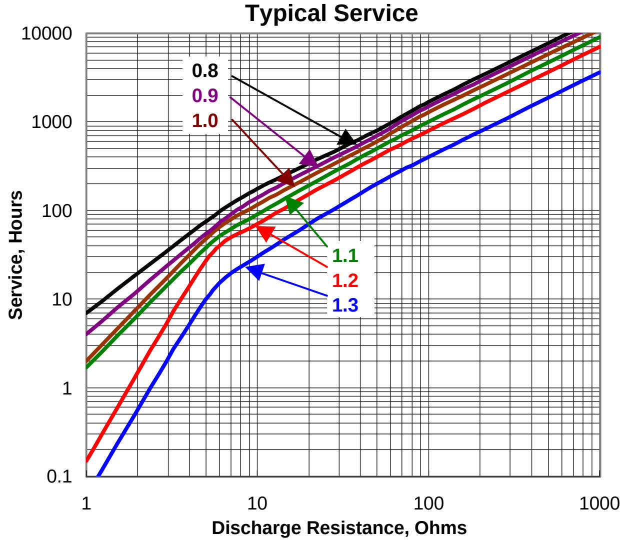
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-13A, IEC-LR20
Battery Voltage: 1.5 Volts
Average Weight: 141.9 grams (5.0 oz.)
Volume: 55.9 cubic centimeters (3.4 cubic inch)
Average Service capacity (to 0.8 Volts / cell): 18000 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 3-350 (size “D”)
Jacket: Plastic Label
Shelf Life: 7 years

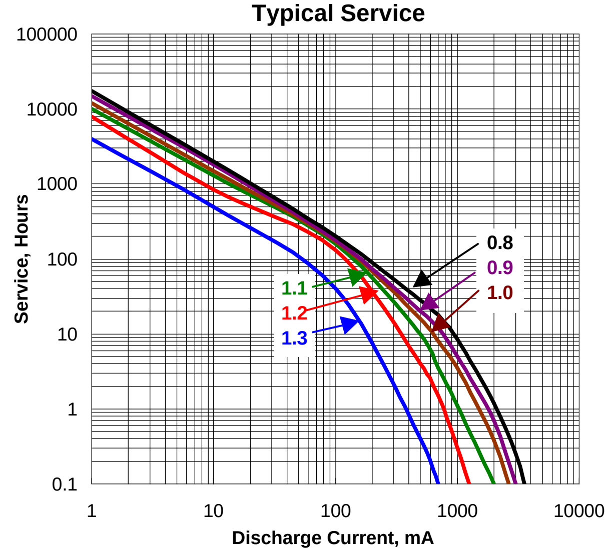
Temperature Effects
Typical Service to 0.8 Volts



Constant Resistance Discharge
Typical Service



Constant Current Discharge
Typical Service



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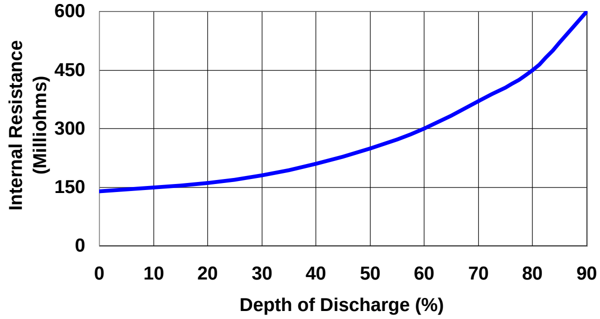
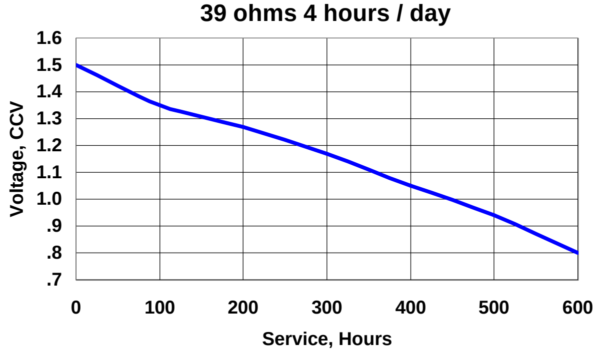
Form No. EBC - 1205F

Internal Resistance
Typical Values at 20° C (70° F)

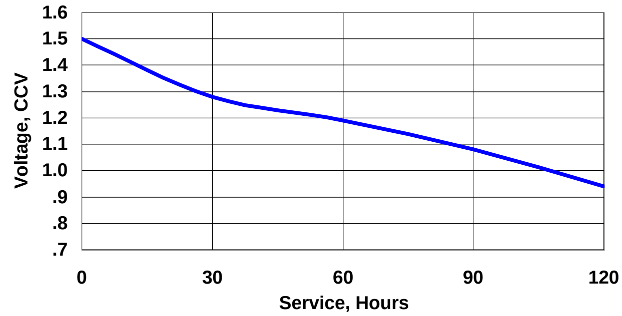


Typical Applications

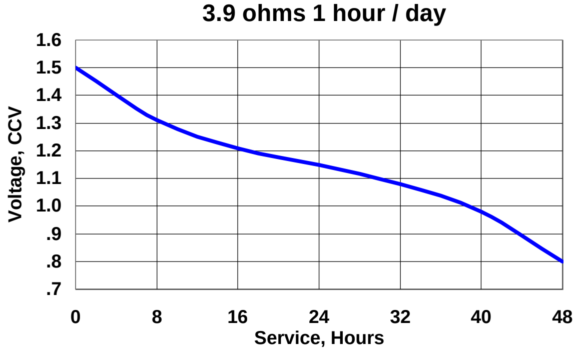
Radio
39 ohms 4 hours / day



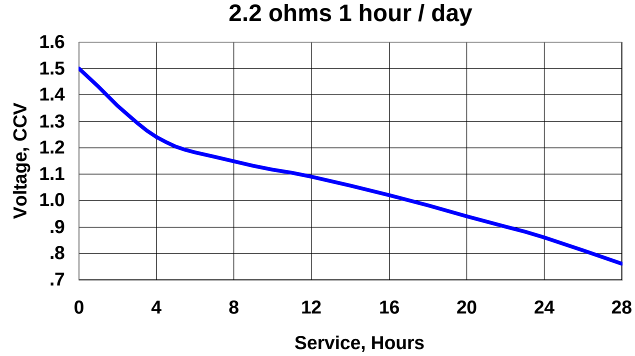
Recorder
10 ohms 4 hours / day



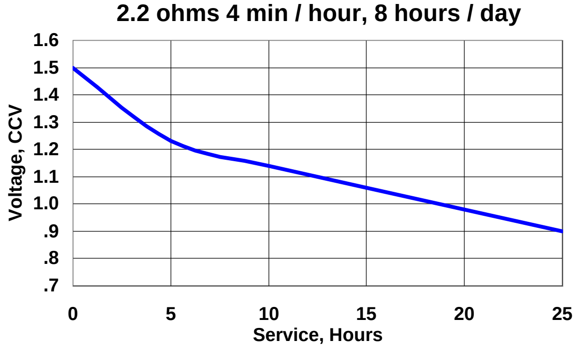
Recorder
3.9 ohms 1 hour / day



Toy
2.2 ohms 1 hour / day



Portable Lighting
2.2 ohms 4 min / hour, 8 hours / day



Important Notice

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

EVEREADY NO. HS6571

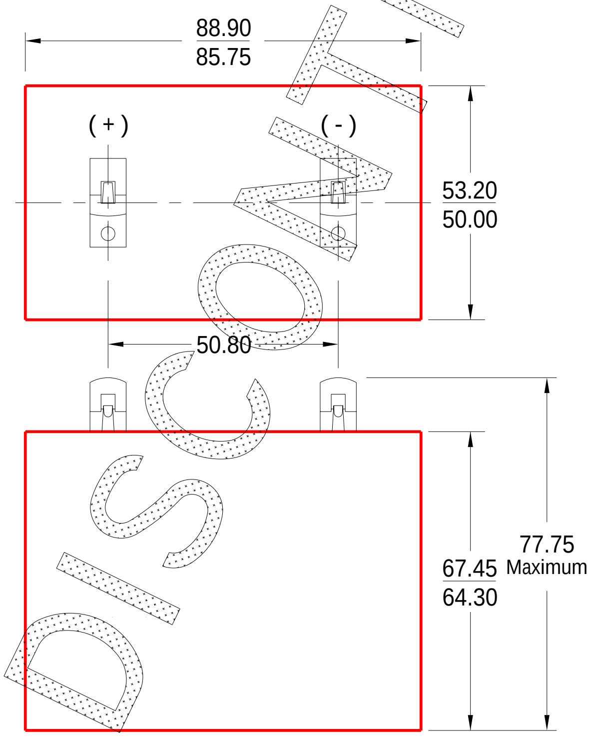
LeClanche ***22.5V***
No Added Mercury or Cadmium
NOT INTENDED FOR RETAIL TRADE

Chemical System: LeClanche-Manganese Dioxide (Zn/MnO_2)

Designation: Not yet available
Battery Voltage: 22.5 Volts
Average Weight: 451 grams (15.9 oz.)
Volume: 319 cubic centimeters (19.5 cubic inch)
Cells: Three No. 15135 in parallel.

Dimensions (mm)

Millimeters	Inches
50.00	1.968
50.80	2.000
53.20	2.094
64.30	2.531
67.45	2.656
77.75	3.061
85.75	3.376
88.90	3.500



Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

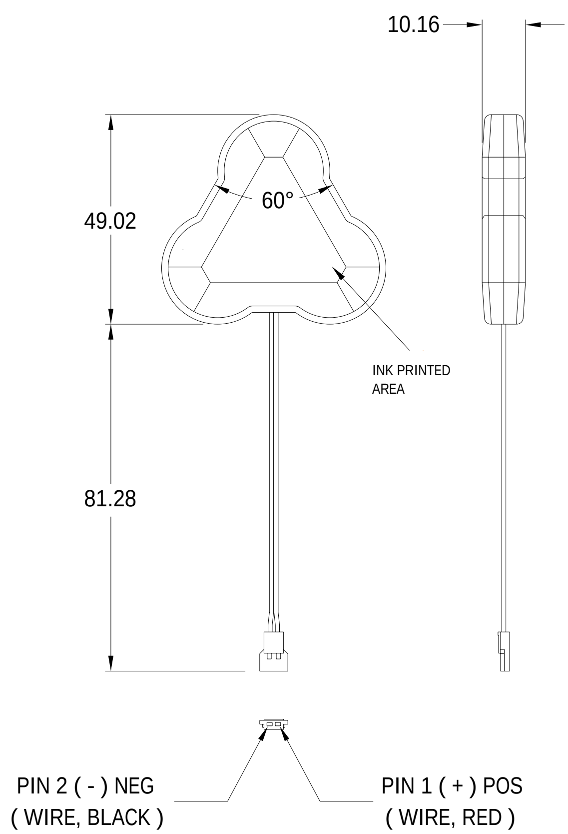
ENERGIZER NO. P2321M

Designation: NiMH Cordless Phone Battery
For Bell South

Nominal Voltage: 3.6 VDC
Typical Capacity: 300 mAh
Typical Weight: 37.7 grams (1.3 oz.)
Special Components: MOLEX Connector

Dimensions (mm)

Millimeters	Inches
2.79	.110
10.16	.400
13.21	.520
49.02	1.930
52.58	2.070
81.28	3.200



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Checkerboard Square
St. Louis, MO 63164
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Internet: www.energizer.com

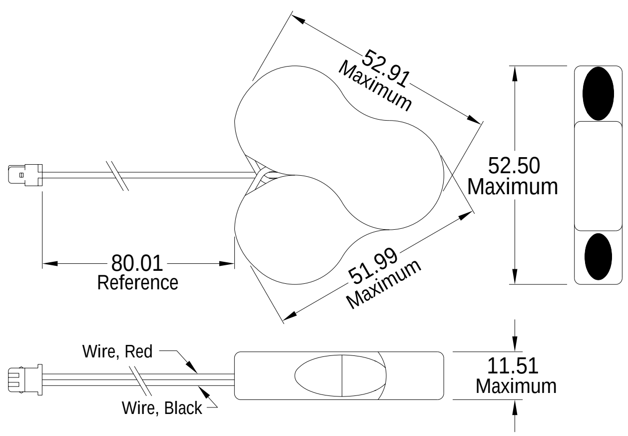
Engineering Data

ENERGIZER NO. P2322

Designation: NiCd Cordless Phone Battery
For Motorola, Panasonic, Uniden

Nominal Voltage: 3.6 VDC
Typical Capacity: 280 mAh
Typical Weight: 45.3 grams (1.6 oz.)

Dimensions (mm)



Millimeters	Inches
11.51	.453
51.99	2.047
52.50	2.067
52.91	2.083
80.01	3.150

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
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Internet: www.energizer.com

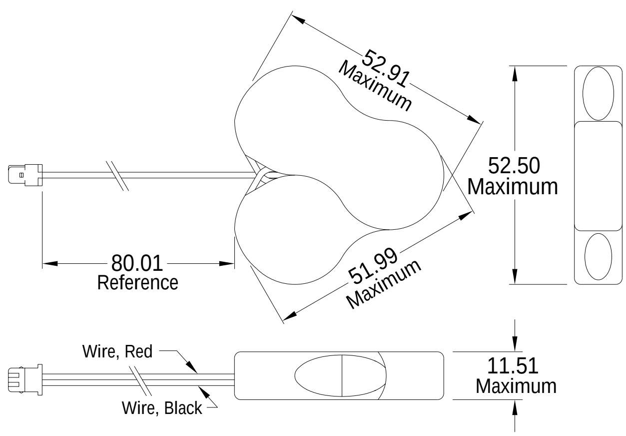
Engineering Data

ENERGIZER NO. P2322M

Designation: NiMH Cordless Phone Battery
For Motorola, Panasonic, Uniden

Nominal Voltage: 3.6 VDC
Typical Capacity: 300 mAh
Typical Weight: 36 grams (1.3 oz.)

Dimensions (mm)



Millimeters	Inches
11.51	.453
51.99	2.047
52.50	2.067
52.91	2.083
80.01	3.150

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Checkerboard Square
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Internet: www.energizer.com

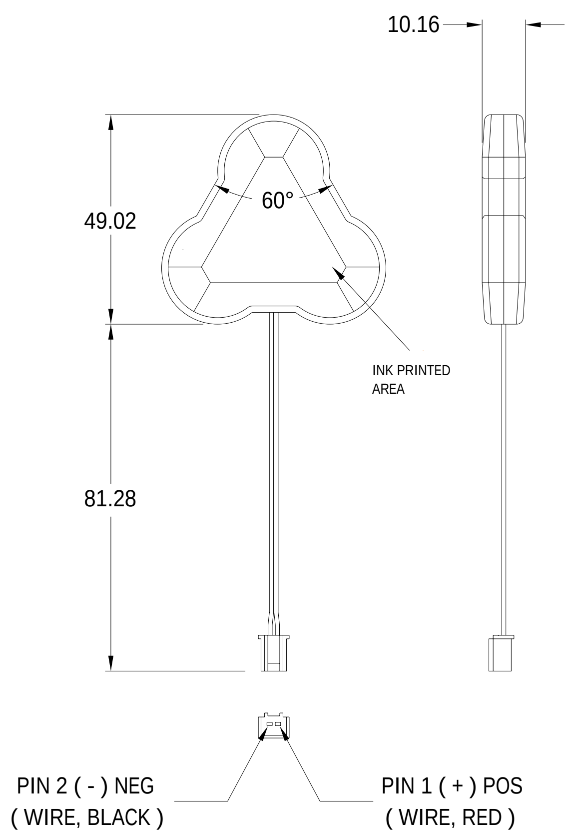
Engineering Data

ENERGIZER NO. P2326M

Designation: NiMH Cordless Phone Battery For Bell South
Nominal Voltage: 3.6 VDC
Typical Capacity: 300 mAh
Typical Weight: 38 grams (1.3 oz.)
Special Components: Hoda Connector P/N H2500-02

Dimensions (mm)

Millimeters	Inches
2.79	.110
10.16	.400
13.21	.520
49.02	1.930
52.58	2.070
81.28	3.200



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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
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Internet: www.energizer.com

Engineering Data

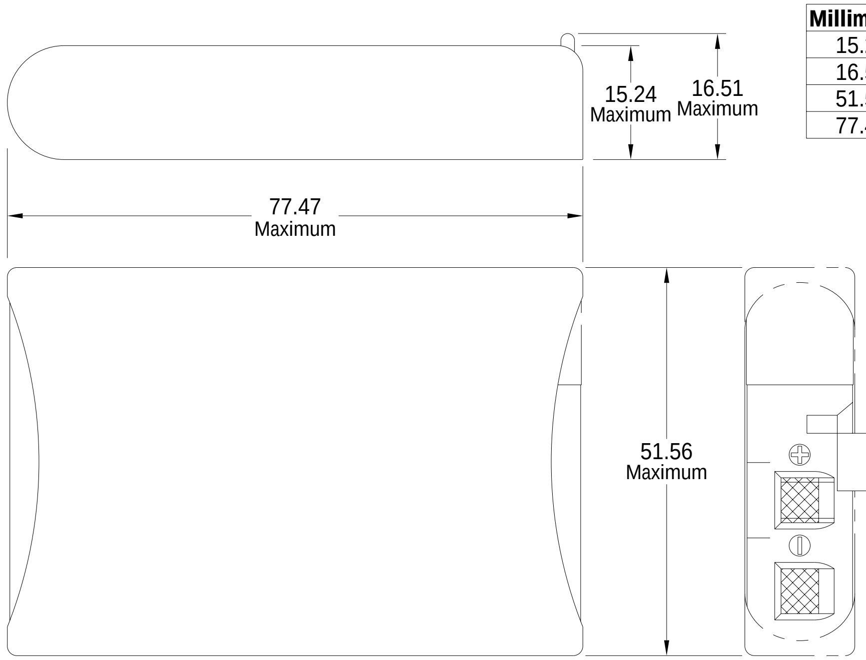
ENERGIZER NO. P7307

Designation: NiCd Cordless Phone Battery
For Uniden EXP901

Nominal Voltage: 3.6 VDC
Typical Capacity: 700 mAh
Typical Weight: 76 grams (2.7 oz.)

Dimensions (mm)

Millimeters	Inches
15.24	.600
16.51	.650
51.56	2.030
77.47	3.050



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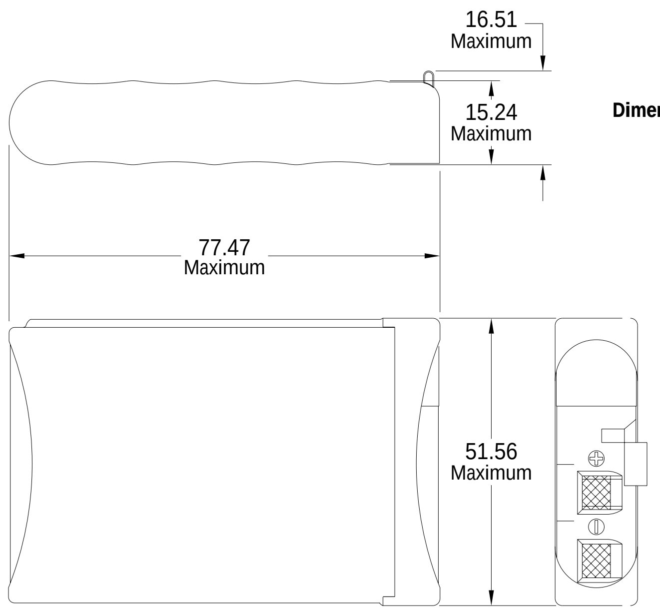
Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
Telephone: 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. P7507

Designation: NiCd Cordless Phone Battery
For Uniden EXP9100-9200

Nominal Voltage: 6 VDC
Typical Capacity: 700 mAh
Typical Weight: 117.0 grams (4.1 oz.)



Dimensions (mm)

Millimeters	Inches
15.24	.600
16.51	.650
51.56	2.030
77.47	3.050

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Eveready Battery Company, Inc.
Checkerboard Square
St. Louis, MO 63164
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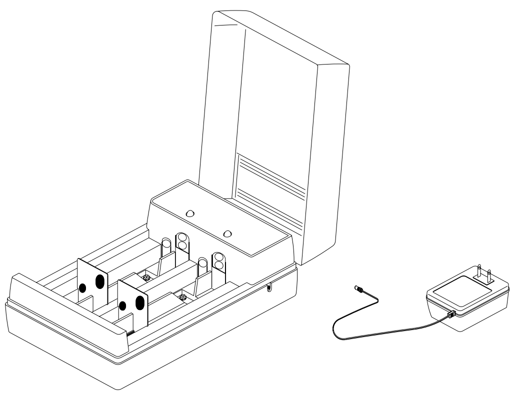
Internet: www.energizer.com

Engineering Data

ENERGIZER MODEL NO. QCC4

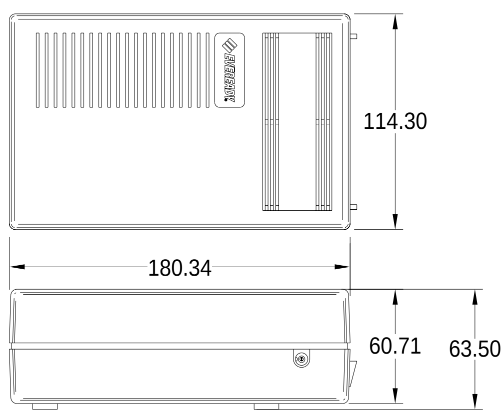
Battery Charger



Designation: Nickel Cadmium Battery Charger
Three Hours Quick Charging
Charge Output: "AA" 210 mA @ 120 VAC
"AAA" 60 mA @ 120 VAC
"C/D" 500 mA @ 120 VAC
"9V(6N)" 10 mA @ 120 VAC
Charge Capability: Two to four "AA", "AAA", "C' or "D"
One to two "9V"
Charging Time: 3 hours for "AA", "AAA", "C" or "D"
10 hours for "9V"
Typical Weight: 657.2 grams (23.2 oz.)
Feature: Timer switch from 3 hour to 10 hour rateafter 3 hours
LED "ON" at 3 hour rate, "OFF" at 10 hour rate

Dimensions (mm)

Millimeters	Inches
60.71	2.390
63.50	2.500
114.30	4.500
180.34	7.100



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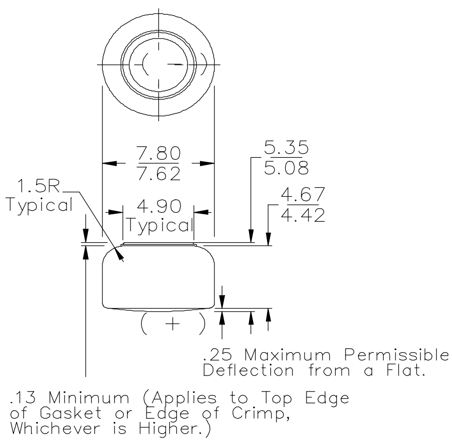
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. S13E

Dimensions (mm)



Millimeters	Inches
0.13	0.005
0.25	0.010
1.50	0.059
4.42	0.174
4.67	0.184
4.90	0.193
5.08	0.200
5.35	0.211
7.62	0.300
7.80	0.307

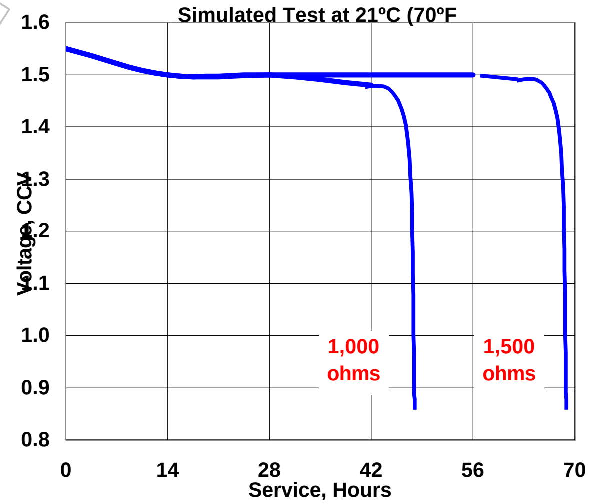
Chemical System: Silver Oxide (Zn/Ag_2O)

Designation: ANSI / NEDA-1181SO, IEC-SR48
Battery Voltage: 1.55 Volts
Average Weight: 1.13 grams (0.040 oz.)
Volume: 0.25 cubic centimeters (0.015 cubic inch)
Average Service capacity (to 1.3 Volt): 68 mAh
(Rated Capacity at 15k ohms, 16 hrs /day at 21°C)

Simulated Application Tests
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	Cutoff Voltage 0.9V hours
16 hours / day	1.03	1,500	68
16 hours / day	1.55	1,000	45

Typical Discharge Characteristics
Simulated Test at 21ºC (70ºF



Internal Resistance The typical impedance of these cells on open circuit and during useful discharge varies from 8-13 ohms. This applies over a frequency range of 40 - 5,000 hertz and at the current drains shown.

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Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
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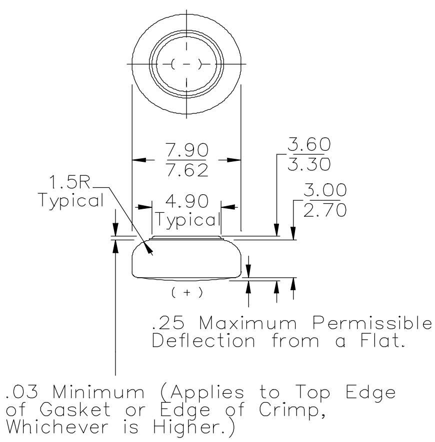
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. S312E

Dimensions (mm)



Millimeters	Inches
0.03	0.001
0.25	0.010
1.50	0.059
2.70	0.106
3.00	0.118
3.30	0.130
3.60	0.142
4.90	0.193
7.62	0.300
7.90	0.311

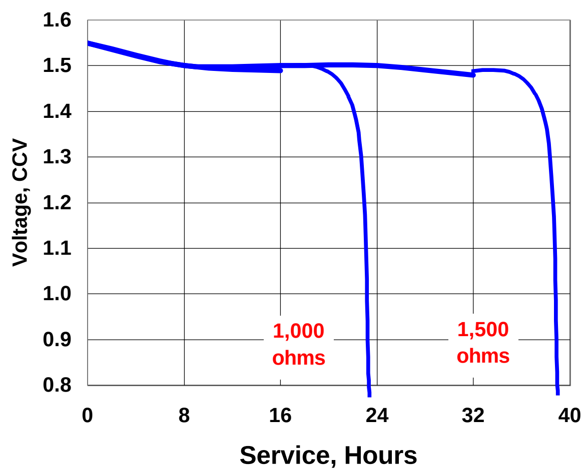
Chemical System: Silver Oxide (Zn/Ag_2O)

Designation: ANSI / NEDA-1179SO, IEC-SR41
Battery Voltage: 1.55 Volts
Average Weight: 0.57 grams (0.02 oz.)
Volume: 0.18 cubic centimeters (0.011 cubic inch)
Average Service capacity (to 1.3 Volt): 38 mAh
(Rated Capacity at 1.5k ohms, 16 hrs/day at 21°C)

Simulated Application Tests
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	Cutoff Voltage 0.9V hours
16 hours / day	1.03	1,500	38
16 hours / day	1.55	1,000	23

Typical Discharge Characteristics
Simulated Test at 21ºC (70ºF)



Internal Resistance The typical impedance of these cells on open circuit and during useful discharge varies from 12-17 ohms. This applies over a frequency range of 40 - 5,000 hertz and at the current drains shown.

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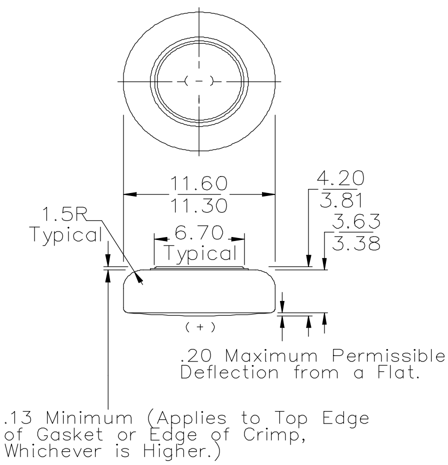
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. S41E

Dimensions (mm)



Millimeters	Inches
0.13	0.005
0.20	0.008
1.50	0.059
3.38	0.133
3.63	0.143
3.81	0.150
4.20	0.165
6.70	0.264
11.30	0.445
11.60	0.457

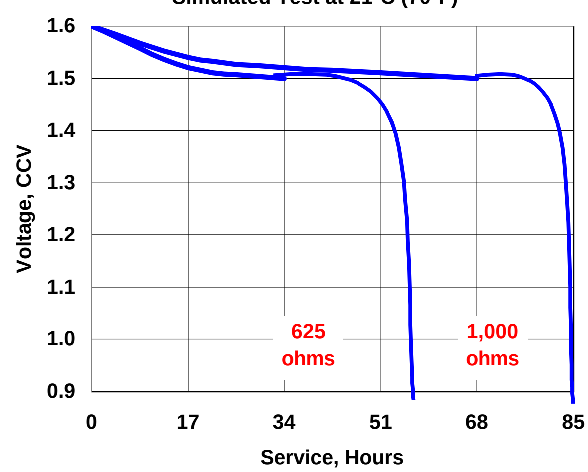
Chemical System: Silver Oxide (Zn/Ag_2O)

Designation: ANSI / NEDA-1183SO, IEC-SR43
Battery Voltage: 1.55 Volts
Average Weight: 1.70 grams (0.06 oz.)
Volume: 0.44 cubic centimeters (0.027 cubic inch)
Average Service capacity (to 1.3 Volt): 125 mAh
(Rated Capacity at 1k ohms, 16 hrs/day at 21°C)

Simulated Application Tests
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	Cutoff Voltage 0.9V hours
16 hours / day	1.55	1,000	85
16 hours / day	2.48	625	55

Typical Discharge Characteristics
Simulated Test at 21ºC (70ºF)



Internal Resistance The typical impedance of these cells on open circuit and during useful discharge varies from 4-13 ohms. This applies over a frequency range of 40 - 5,000 hertz and at the current drains shown.

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Eveready Battery Company, Inc.
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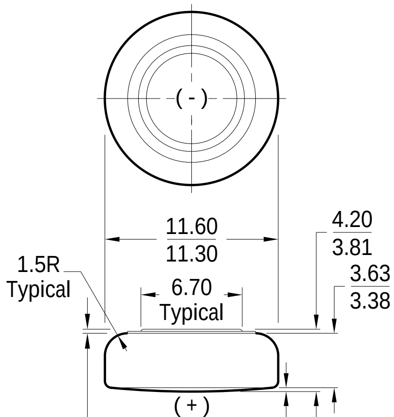
Engineering Data

ENERGIZER NO. 386

Dimensions (mm)



Millimeters	Inches
.13	.005
.20	.008
1.50	.059
3.38	.133
3.63	.143
3.81	.150
4.20	.165
6.70	.264
11.30	.445
11.60	.457

.20 Maximum Permissible Deflection from a Flat.

.13 Minimum (Applies to Top Edge of Gasket or Edge of Crimp, Whichever is Higher.)

Chemical System: Silver Oxide ($Zn/Ag_2 0$)

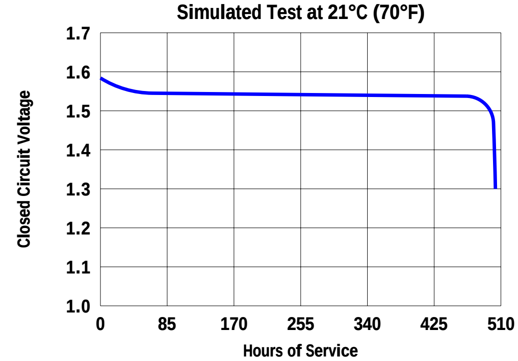
Designation: ANSI / NEDA-1133SO, IEC-SR43
Battery Voltage: 1.55 Volts
Average Weight: 1.7 grams (.060 oz.)
Volume: .44 cubic centimeters (.027 cubic inch)
Average Service Capacity (to 1.3 Volt): 120 mAh
(Rated capacity at 6.5K ohms continuous at 21°C)

DESIGNED FOR USE ON CONTINUOUS LOW DRAIN -HIGH PULSE DRAIN ON DEMAND

SIMULATED APPLICATION TESTS
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	CUTOFF VOLTAGE 1.3V hours
24 hours / day	**.238**	**6,500**	**503**

TYPICAL DISCHARGE CHARACTERISTICS
Simulated Test at 21°C (70°F)



INTERNAL RESISTANCE Closed circuit voltage no less than 1.30 volts on a load of 100 ohms at 21°C (70°F) for 0.1 to 2.0 seconds.

Typical closed circuit voltage during discharge on a load of 100 ohms for 5.0 seconds

Depth of Discharge as Percent of Rated Capacity

Temperature	0%	40%	80%
21°C (70°F)	1.45V	1.36V	1.28V
-10°C (14°F)	1.07V	0.94V	0.82V

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Form No. EPS - 4334A

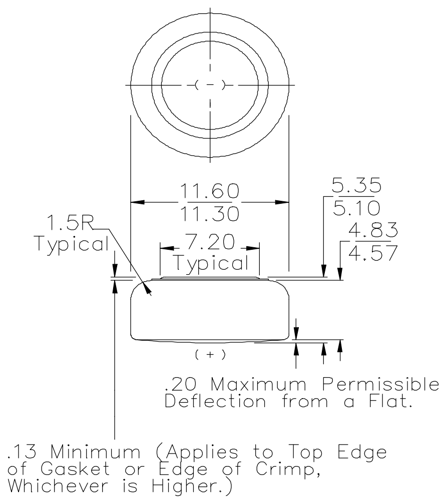
Eveready Battery Company, Inc.

Checkerboard Square
St. Louis, MO 63164
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. S76E

Dimensions (mm)



Millimeters	Inches
0.13	0.005
0.20	0.008
1.50	0.059
4.57	0.180
4.83	0.190
5.10	0.201
5.35	0.211
7.20	0.283
11.30	0.445
11.60	0.457

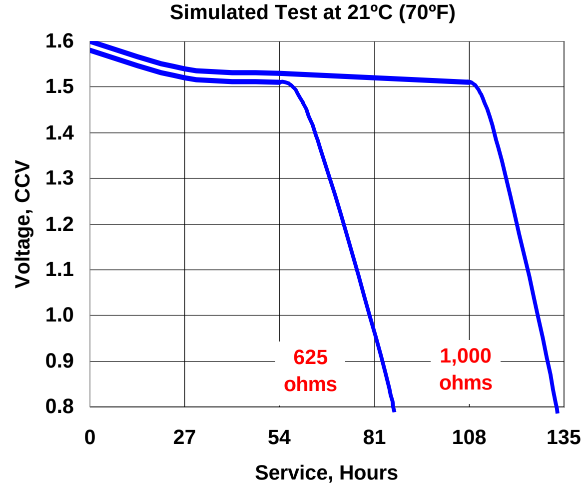
Chemical System: Silver Oxide (Zn/Ag_2O)

Designation: ANSI / NEDA-1184SO, IEC-SR44
Battery Voltage: 1.55 Volts
Average Weight: 2.27 grams (0.08 oz.)
Volume: 0.57 cubic centimeters (0.035 cubic inch)
Average Service capacity (to 1.3 Volt): 195 mAh
(Rated Capacity at 625 ohms, 16 hrs /day at 21°C)

Simulated Application Tests
Estimated Average Service at 21°C (70°F)

Schedule	Typical Drains @ 1.55V (milliamperes)	Load (ohms)	Cutoff Voltage 0.9V hours
16 hours / day	1.55	1,000	134
16 hours / day	2.48	625	84

Typical Discharge Characteristics
Simulated Test at 21ºC (70ºF)



Internal Resistance The typical impedance of these cells on open circuit and during useful discharge varies from 7-12 ohms. This applies over a frequency range of 40 - 5,000 hertz and at the current drains shown.

Important Notice

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Application Manuals:

- Carbon Zinc
- Cylindrical Alkaline
- Lithium Cylindrical - L91
- Lithium Miniature
- Manganese Dioxide
- Nickel Cadmium
- Nickel Metal Hydride
- Silver Oxide
- Zinc Air

Technical Brochures:

- Typical Characteristics of All Batteries
- Temperature Effects
- Design and Safety Considerations

Reference Pages:

- Battery Cross Reference Tables
- Glossary of Terms
- EBC Contacts and Locations
- Reference Materials
- Product Safety Data Sheets

Rechargeable Batteries

Click on the appropriate battery type to be taken to an Application Manual:

- Nickel-Metal Hydride
- Nickel Cadmium

Primary Batteries

Click on the appropriate battery type to be taken to an Application Manual:

- Alkaline
- Carbon Zinc (Zn/MnO_2)
- Lithium
  - Lithium L91
  - Lithium Miniature
  - 9V Lithium
- Miniature Manganese Dioxide
- Silver Oxide (Zn/Ag_2O)
- Zinc Air (Zn/O_2)

Technical Information

Battery Engineering Guide

Datasheets | Application Manuals | Contacts | Product Safety Datasheets

Information printed on this and subsequent pages represents performance of typical batteries. Since the characteristics of individual batteries are sometimes modified, those considering the use of a particular battery should contact the nearest Energizer Sales office for latest information. This web site and its contents contain general background information only and none of the information constitutes a representation or warranty by Eveready Battery Company, Inc. concerning any batteries.

Technical Marketing

Revised: March 29, 2002

Energizer e²

Alkaline Application Manual

HOME

ALKALINE CONSUMER / ENERGIZER e2

(Click on battery to locate in table below.)

Click product "name" to view engineering datasheet or click "picture" to view larger image.											
Name	**Picture**	**Size**	**Capacity * (mAh)**	**Voltage (nom.)**	**ANSI/ NEDA**	**IEC**	**Weight (g)**	**Diam. (max mm)**	**Height (max mm)**	**Length (max mm)**	**Width (max mm)**
E96		AAAA	595	1.5	25A	N/A	6.5	8.3	42.5	N/A	N/A
X522		9V	595	9	1604A	6LR61	45.6	N/A	48.5	26.5	17.5

X91		AA	3135	1.5	15A	LR6	23	14.5	50.5	N/A	N/A
X92		AAA	1375	1.5	24A	LR03	11.5	10.5	44.5	N/A	N/A
X93		C	8350	1.5	14A	LR14	66.2	26.2	50	N/A	N/A
X95		D	18000	1.5	13A	LR20	141.9	34.2	61.5	N/A	N/A

*** Typical capacity rating based on 25 mA continuous current drain to 0.8 volts cutoff per cell. See datasheets for details.**
For active JIS numbers , refer to IEC.

Eveready Alkaline

[Alkaline Application Manual](#)

HOME

ALKALINE / EVEREADY

(Click on battery to locate in table below.)

Click product "name" to view engineering datasheet or click "picture" to view larger image.

Name	Picture	Size	Capacity * (mAh)	Voltage (nom.)	ANSI/ NEDA	IEC	Weight (g)	Diam. (max mm)	Height (max mm)	Length (max mm)	Width (max mm)
A522		9V	595	9	1604A	6LR61	45.6	N/A	48.5	26.5	17.5
A91		AA	2565	1.5	15A	LR6	23	14.5	50.5	N/A	N/A
A92		AAA	1125	1.5	24A	LR03	11.5	10.5	44.5	N/A	N/A

A93		C	8350	1.5	14A	LR14	66.2	26.2	50	N/A	N/A
A95		D	18000	1.5	13A	LR20	141.9	34.2	61.5	N/A	N/A

*** Typical capacity rating based on 25 mA continuous current drain to 0.8 volts cutoff per cell. See datasheets for details.**
For active JIS numbers , refer to IEC.

Alkaline Consumer & OEM

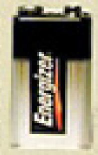
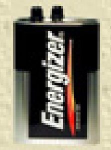
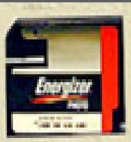
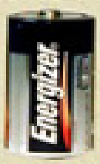
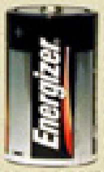
Alkaline Application Manual

HOME

ENERGIZER CONSUMER ALKALINE

(Click on battery to locate in table below.)

Click product "name" to view engineering datasheet or click "picture" to view larger image.											
Name	**Picture**	**Size**	**Capacity * (mAh)**	**Voltage (nom.)**	**ANSI/ NEDA**	**IEC**	**Weight (g)**	**Diam. (max mm)**	**Height (max mm)**	**Length (max mm)**	**Width (max mm)**
521		Lantern	52000	6	918A	N/A	1900	N/A	125.4	136.5	73

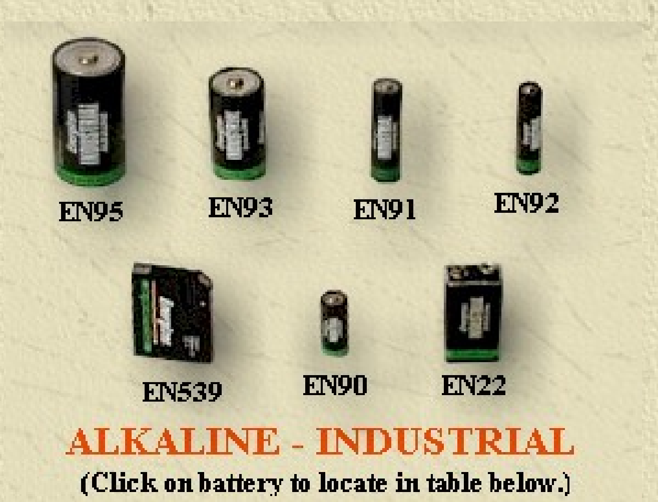
522		9V	595	9	1604A	6LR61	45.6	N/A	48.5	26.5	17.5
528		Lantern	26000	6	915A	N/A	885	N/A	109.5	66.7	66.7
529		Lantern	26000	6	908A	N/A	885	N/A	115	66.7	66.7
539		J	595	6	1412AP	N/A	30	N/A	48.5	35.55	9.2
E90		N	1000	1.5	910A	LR1	9	11.95	29.35	N/A	N/A
E91		AA	2850	1.5	15A	LR6	23	14.5	50.5	N/A	N/A
E92		AAA	1250	1.5	24A	LR03	11.5	10.5	44.5	N/A	N/A
E93		C	8350	1.5	14A	LR14	66.2	26.2	50	N/A	N/A
E95		D	18000	1.5	13A	LR20	141.9	34.2	61.5	N/A	N/A

*** Typical capacity rating based on 25 mA continuous current drain to 0.8 volts cutoff per cell. See datasheets for details.**
For active JIS numbers , refer to IEC.

Alkaline Industrial

Alkaline Application Manual

HOME MORE



Click product "name" to view engineering datasheet or click "picture" to view larger image.

Name	Picture	Size	Capacity * (mAh)	Voltage (nom.)	ANSI/ NEDA	IEC	Weight (g)	Diam. (max mm)	Height (max mm)	Length (max mm)	Width (max mm)
EN91		AA	2850	1.5	15A	LR6	23	14.5	50.5	N/A	N/A
EN92		AAA	1250	1.5	24A	LR03	11.5	10.5	44.5	N/A	N/A
EN93		C	8350	1.5	14A	LR14	66.2	26.2	50	N/A	N/A
EN95		D	18000	1.5	13A	LR20	141.9	34.2	61.5	N/A	N/A
EN22		9V	595	9.0	1604A	6LR61	45.6	N/A	48.5	26.5	17.5
EN539		J	595	6.0	1412AP	N/A	30	N/A	48.5	35.55	9.2

EN90		N	1000	1.5	910A	LR1	9	11.95	29.35	N/A	N/A

*** Typical capacity rating based on 25 mA continuous current drain to 0.8 volts cutoff per cell. See datasheets for details. For active JIS numbers, refer to IEC.**

ALKALINE - INDUSTRIAL

(Click on battery to locate in table below.)

Name	Picture	Size	Capacity * (mAh)	Voltage (nom.)	ANSI/ NEDA	IEC	Weight (g)	Diam. (max mm)	Height (max mm)	Length (max mm)	Width (max mm)
EN6		6 " Cylin.	52000	1.5	906AC	LR40	482	66.7	170	N/A	N/A
EN529		Lantern	26000	6.0	908AC	N/A	885	N/A	115	66.7	66.7
EN715		Lantern	52000	7.5	903AC	5LR25-2	2.3 Kg	N/A	97	184.2	103.2
EDL4A		Pack	2850	6.0	N/A	N/A	98.8	N/A	50.29	56.41	14.43
EDL4AC		Pack	2850	6.0	N/A	N/A	100.6	N/A	49.07	28.42	28.50
EDL4AS		Pack	2850	6.0	N/A	N/A	99.7	N/A	50.29	63.86	14.43
EDL6A		Pack	2850	9.0	N/A	N/A	150.1	N/A	50.29	49.61	26.62

*** Typical capacity rating based on 25 mA continuous current drain to 0.8 volts cutoff per cell. See datasheets for detail. For active JIS numbers, refer to IEC.**

Alkaline OEM Only

Alkaline Application Manual

HOME

ALKALINE - OEM
(Click on battery to locate in table below.)

Click product "name" to view engineering datasheet or click "picture" to view larger image.							
Name	**Picture**	**Size**	**Capacity * (mAh)**	**Voltage (nominal)**	**Weight (g)**	**Diameter (max mm)**	**Height (max mm)**
3-312		AAA	1155	1.5	11.5	10.29	42.82

3-312I		AAA	1155	1.5	11.5	10.29	42.82
3-315		AA	2850	1.5	22.4	13.99	47.96
3-315I		AA	2850	1.5	22.4	14.3	48.41
3-315INNC		AA	2850	1.5	22.4	14.3	47.6
3-315IWC		AA	2850	1.5	23.0	14.3	50.5
3-315WC		AA	2850	1.5	22.5	13.99	50.5
3-335		C	8350	1.5	64.8	25.25	46.7
3-335I		C	8350	1.5	64.8	26.2	47.17
3-335NNCI		C	8350	1.5	64.1	26.2	46.74

3-335WC		C	8350	1.5	65.5	25.25	50
3-350		D	18000	1.5	137.8	33.2	57
3-350I		D	18000	1.5	137.8	34.15	57.45
3-350NNCI		D	18000	1.5	137.8	34.15	57.05
3-350IWC		D	18000	1.5	141.9	34.15	61.1
3-350WC		D	18000	1.5	139.4	33.2	61.1
3-361		F	26000	1.5	201	32.28	87.81
3-361I		F	26000	1.5	201	32.94	87.81
3-0316		AAAA	595	1.5	6.2	7.85	39.8
3-0316I		AAAA	595	1.5	6.2	8.23	39.8

3-0411		N	1000	1.5	8.8	11.45	27.86
3-0411I		N	1000	1.5	9	11.45	28.12

*** Typical capacity rating based on 25 mA continuous current drain to 0.8 volts cutoff per cell. See datasheets for detail.**
For active JIS numbers, refer to IEC

Lithium Miniature

[Miniature Lithium Application Manual](#)

HOME

LITHIUM COIN BATTERIES

Click product "name" to view engineering datasheet or click "picture" to view larger image.

Name	Picture	Size	Capacity * (mAh)	Voltage (nom.)	ANSI/ NEDA	IEC	Weight (g)	Diam. (max mm)	Height (max mm)
CR1025		COIN	30	3	5033LC	CR1025	0.7	10.0	2.5
CR1216		COIN	29	3	5034LC	CR1216	0.7	12.5	1.6
CR1220		COIN	40	3	5012LC	CR1220	0.8	12.5	2.0
CR1225		COIN	50	3	5020LC	CR1225	0.9	12.5	2.5
CR1616		COIN	55	3	5021LC	CR1616	1.2	16	1.6
CR1620		COIN	79	3	5009LC	CR1620	1.4	16	2.0
CR1632		COIN	130	3	N/A	N/A	1.8	16	3.2
CR2012		COIN	58	3	N/A	CR2012	1.3	20	1.2

CR2016		COIN	80	3	5000LC	CR2016	1.9	20	1.6
CR2025		COIN	170	3	5003LC	CR2025	2.8	20	2.5
CR2032		COIN	225	3	5004LC	CR2032	3.3	20	3.2
CR2320		COIN	135	3	5020LC	CR2320	3.0	23	2.0
CR2430		COIN	290	3	5011LC	CR2430	4.6	24.5	3.0
CR2450		COIN	575	3	5029LC	CR2450	6.9	24.5	5.0

*** Capacity at Rating Drain. See datasheets for details.**
For active JIS numbers, refer to IEC.

Rechargeable Product Offerings

Consumer

- NiMH
- Accessories - Charger
- Packs
  - Camcorder
  - Cellular
  - Cordless
  - Digital Camera

Back to Nickel-Cadmium Application Manual

Back to Nickel-Metal Hydride Application Manual

Back to Index Printer Friendly Version

Nickel Cadmium Batteries

Table of Contents:

The nickel-cadmium battery is a remarkable device. More than fifty years of successful use has proved this point. Nickel-cadmium batteries may be recharged many times and have a relatively constant potential during discharge. They will stand more electrical and physical abuse than any other cell, have good low temperature performance characteristics, and are more than competitive with other systems in terms of cost per hour of use. They are true storage batteries using one of the very best electrochemical systems.

"Eveready" Sealed Nickel-cadmium Cells

The nickel-cadmium cell has been used in Europe for many years in its original form, as a vented or unsealed cell. Technological advances have made possible the extension of the nickel-cadmium system to small hermetically sealed batteries-rechargeable batteries that are free of the usual routine maintenance, such as the addition of water. These developments have brought the economic advantages of rechargeability to small batteries.

"Eveready" sealed nickel-cadmium cells can be recharged many times to give long useful life, and are not adversely affected by standing many months, either charged or discharged.

These high quality batteries, when used within their recommended ratings and in applications where the use of rechargeable cells is justified, will provide economical, trouble-free service. New portable devices requiring more energy than is economically available from ordinary primary batteries are practical with this complete line of rechargeable batteries.

Applications

"Eveready" sealed nickel-cadmium batteries are ideally suited for use in many types of battery-operated equipment. Some of the many applications are listed here:

- Calculators

- Cassette players and recorders
- Dictating machines
- Digital Cameras
- Instruments
- Personal Pagers
- Photoflash equipment
- Portable communications equipment
- Portable hand tools and appliances
- Portable computers
- Radios
- Radio control models
- Shavers
- Tape recorders
- Television sets
- Toothbrushes

Operation of the Sealed Nickel-Cadmium Battery

Any secondary cell is a combination of active materials which can be electrolytically oxidized and reduced repeatedly. The oxidation of the negative electrode occurring simultaneously with the reduction of the positive generates electric power. In a rechargeable battery both electrode reactions are reversible and the input of current in the proper direction from an outside source will drive the primary or discharge reaction backwards and in effect recharge the electrodes.

In the uncharged condition the positive electrode of a nickel-cadmium cell is nickelous hydroxide, the negative cadmium hydroxide. In the charged condition the positive electrode is nickelic hydroxide, the negative metallic cadmium. The electrolyte is potassium hydroxide. The average operating voltage of the cell under normal discharge conditions is about 1.2 volts. The over-all chemical reaction of the nickel-cadmium system can be considered as:

(Charged) KOH (Discharged)

$$Cd + 2NiOOH + 2H_2O \Leftrightarrow Cd(OH)_2 + 2Ni(OH)_2$$

During the latter part of a recommended charge cycle and during overcharge, nickel-cadmium batteries generate gas. Oxygen is generated at the positive (nickel) electrode after it becomes fully charged and hydrogen is formed at the negative (cadmium) electrode when it reaches full charge.

These gases must be vented from the conventional nickel-cadmium system. In order for the system to be overchargeable while sealed, the evolution of hydrogen must be prevented and provisions made for this reaction of oxygen within the cell container. These things are accomplished by the following:

- The battery is constructed with excess capacity in the cadmium electrode.
- Starting with both electrodes fully discharged, charging the battery causes the positive electrode to reach full charge first and it starts oxygen generation. Since the negative (cadmium) electrode has not reached full charge hydrogen will not be generated.
- The cell is designed so that the oxygen formed in the positive electrode can reach the metallic cadmium surface of the negative electrode which it oxidizes directly.

- Thus, in overcharge, the cadmium electrode is oxidized at a rate just sufficient to offset input energy, keeping the cell in equilibrium indefinitely. At this point of equilibrium the positive electrode is fully charged and the negative is somewhat less than fully charged.

Polarity Reversal:

When cells are connected in series and discharged completely, small cell capacity differences will cause one cell to reach complete discharge sooner than the remainder. The cell which reaches full discharge first will be driven into reverse by the others. When this happens in an ordinary nickel-cadmium sealed cell, oxygen will be evolved at the cadmium electrode and hydrogen at the nickel electrode. Gas pressure will increase as long as current is driven through the cell and eventually it will either vent or burst. This condition is prevented in some sealed nickel-cadmium cells by special construction features. These include the use of a reducible material in the positive in addition to the nickel hydroxide, to suppress hydrogen evolution when the positive expires. If cadmium oxide is used it is possible to prevent hydrogen formation and to react the oxygen formed at the negative by same basic process used to regulate pressure during overcharge.

A cell is considered electrochemically protected against reversal of polarity if, after discharge at the 10 hour rate down to 1.1 volts, it may receive an additional 5 hour discharge with the same current without being damaged or otherwise affected. "Eveready" cylindrical cells are protected against cell rupture, caused by gassing generated during polarity reversal, by a pressure relief vent.

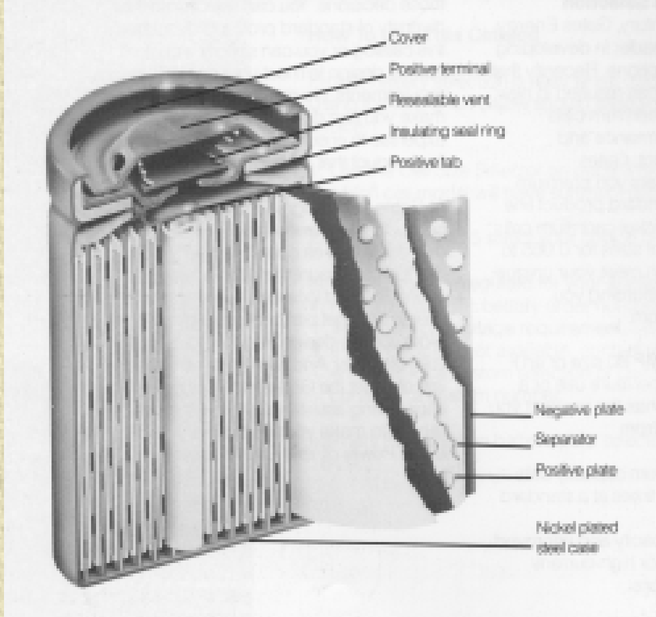
Energizer Sealed Nickel-Cadmium Rechargeable Batteries

Energizer nickel-cadmium cells are available in cylindrical configuration and range in capacity up to 5 Amp hours in sizes from AAA to D.

Cylindrical Cells

This cell type incorporates a different electrode arrangement than the button cell. Sintered plates are used in all cylindrical cells for the positive electrode. This electrode consists of thin, highly porous nickel plaques impregnated with active materials. The plaque is made by heating nickel powder in an inert atmosphere until the particles are welded together. The metallic phase serves as a highly conductive supporting structure for the electrode. The structure of the plate is such that a large surface is furnished for reaction of the active materials. With the sintered electrode it is possible to build cells of very low internal resistance.

The negative electrode of most Energizer cylindrical cells is a pasted electrode which consists of blended active materials pressed onto a metal carrier. It is this electrode that gives Energizer cylindrical nickel-cadmium cells outstanding cycle life, long term overcharge capability, with essentially no fade and with little or no memory effect.



Sealed nickel-cadmium cells under certain abuse conditions such as excessive charge or overcharge rate, deep discharge with subsequent polarity reversal, may develop high internal gas pressure. Usually the gas is oxygen, although hydrogen is also evolved in some cases. Either or both hydrogen and oxygen must be vented.

All Energizer high rate cylindrical cells have a resealing pressure vent. This vent permits the cell to release excess gas evolved if the cell, for example, is abused. When the internal pressure has dropped to an acceptable level, the vent will reseal, permitting the cell to be recycled in the normal manner with little or no further loss of electrolyte or capacity. Repeated venting will reduce capacity and cycle life.

Contact Material

External electrical connections can be made with any good conductor having adequate current handling capabilities.

Potting

Nickel-cadmium cells or batteries of any type should not be totally potted. Energizer cells have resealable vent mechanisms which wold be rendered inoperative by the potting compound.

Electrical Characteristics

Energizer sealed nickel-cadmium cells exhibit relatively constant discharge voltages. They can be recharged many times for long lasting economical power. They are small convenient packages of high energy output, hermetically sealed in steel cases, leak resistant and will operate in any position. The cells have very low internal resistance and impedance, are rugged and highly resistant to shock and vibration.

The temperature range under which these cells may be operated is wide. Use at high temperatures, however, or charging at higher than recommended rates, or repeated discharge beyond the normal cutoffs may be harmful.

Capacity

The capacity rating of Energizer nickel-cadmium cells and batteries is based upon output in discharge at the 1 hour rate to an endpoint of 1.0V/cell for all cylindrical cells. If current is withdrawn at faster rates than these standards, capacity is decreased.

Paralleling of Cells

"Eveready" sealed nickel-cadmium cells should not be charged in parallel unless each cell or series string of the parallel circuit has its own current limiting resistor. Minor differences in internal resistance of the cells may result, after cycling, in extreme variation in their states of charge. This may lead to overcharge at excessive currents in some cells and undercharge in other cells.

Voltage Characteristics

Except in the case of complete discharge, neither cell condition nor state of charge can be determined by open circuit voltage. Within a short while after charging it may be above 1.4 volts. It will fall shortly thereafter to 1.35V and continue to drop as the cell loses charge.

During discharge, the average voltage of a sealed nickel-cadmium battery is approximately 1.2 volts per cell. At normal discharge rates the characteristic is very nearly flat until the cell approaches complete discharge. The battery provides most of its energy above 1.0 volt per cell. If the cell is discharged with currents exceeding the rated value, however, the voltage characteristic will have more of a slope, a lower endpoint voltage will be necessary and the ampere hours per cycle will be reduced.

High Current Pulse Discharge

High rate nickel-cadmium cells will deliver exceedingly high currents. If they are discharge continuously under short circuit conditions, self-heating may do irreparable damage.

The heat problems vary somewhat from one cell type to another, but in most cases internal metal strip tab connectors overheat or the electrolyte boils. In some instances both events occur.

General overheating is normally easy to prevent because the outside temperature of the battery can be used to indicate when rest, for cooling, is required. In terms of cutoff temperature during discharge, it is acceptable practice to keep the battery always below 45ºC (113ºF).

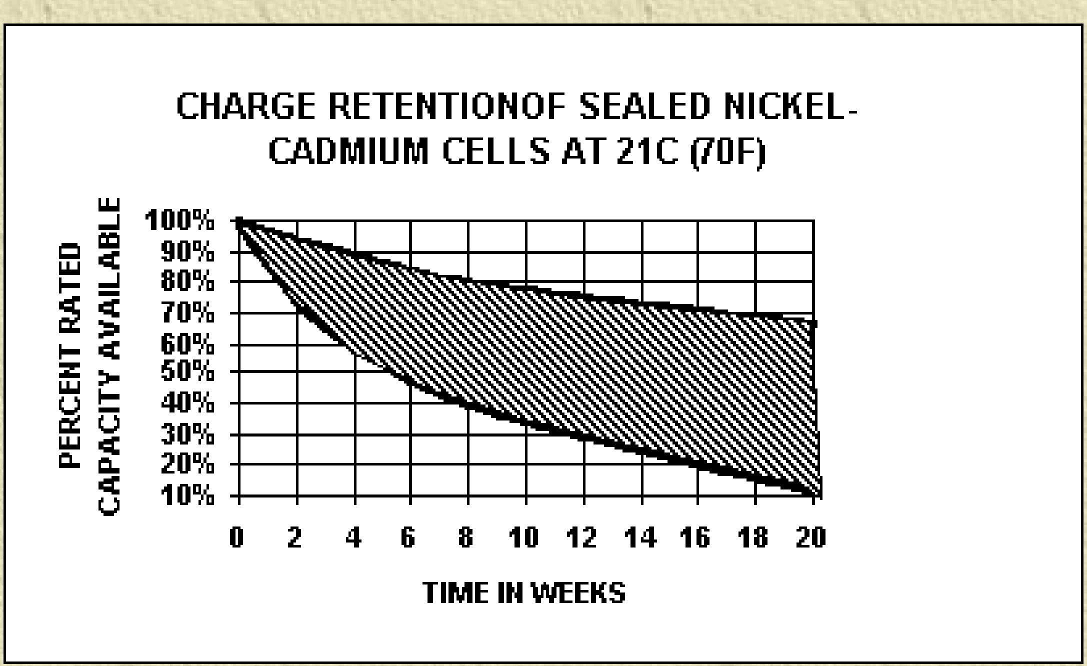
The overheated internal connectors are difficult to detect. This form of overheating takes place in a few seconds or less, and overall cell temperature may hardly be affected. It is thus advisable to withdraw no more ampere seconds per pulse, and to withdraw it at no greater average current per complete discharge, than recommended on the data sheet for the "Eveready" cell in question. In special cases, where cooling of the cell or battery is likely to be poor, or unusually good, special tests should be run to check the important temperatures before any duty cycle adjustment is made.

Output capacity is any discharge composed of pulses is difficult to predict accurately because there are infinite combinations of current, "on" time, rest time, and end point voltage. Testing on a specific cycle is the simplest way to get a positive answer.

Self-Discharge

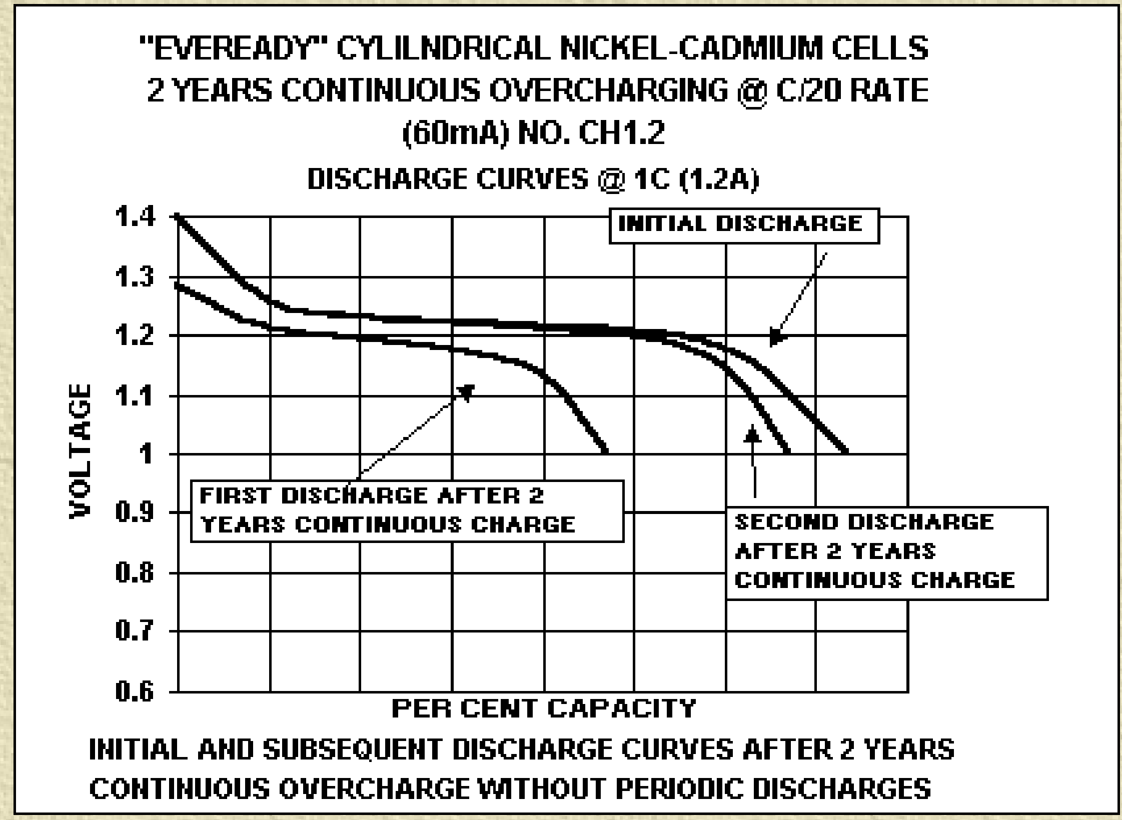
Self-discharge characteristics of Energizer nickel-cadmium cells are shown in the chart below. The characteristics are shown as a decline in percent of rated capacity available.
Self-discharge is increased by elevated temperatures. Batteries are not harmed even if not used

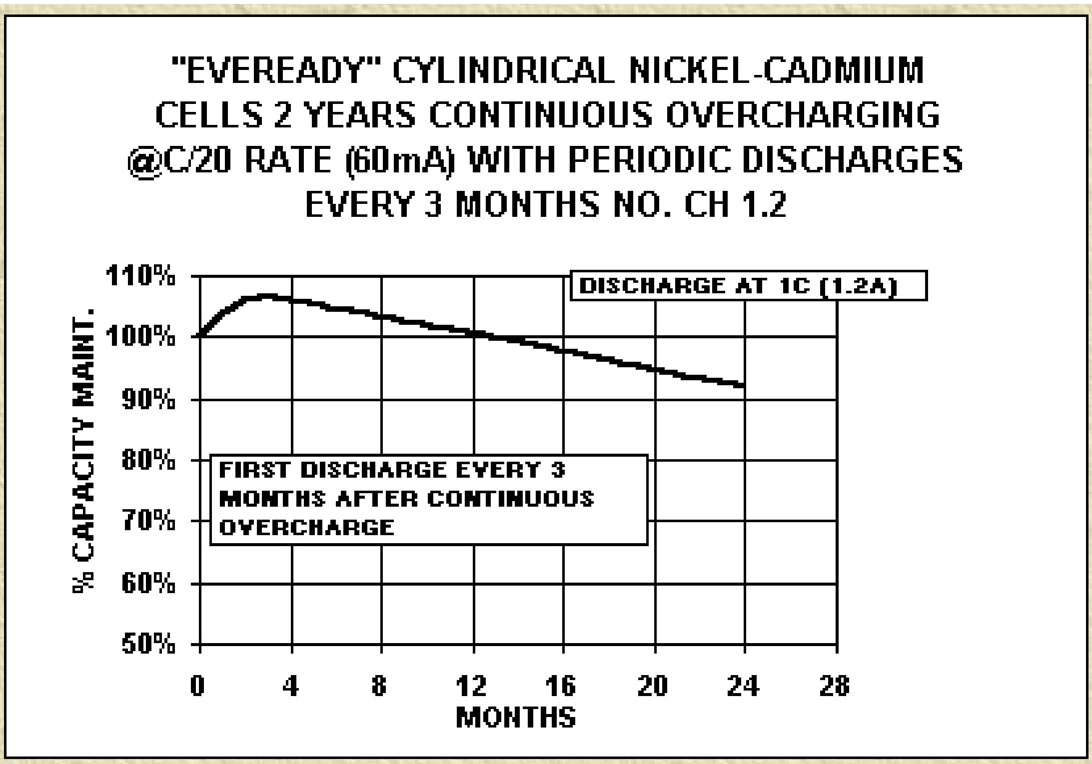
for long periods of time.



Continuous Overcharge

The overcharge capability of Energizer cylindrical nickel-cadmium cells is outstanding. The next chart illustrates initial and subsequent discharge curves after 2 years continuous overcharge without periodic discharges. The first discharge after the 2 year charge period yields a slightly reduced voltage curve and 65% capacity. The second cycle after 2 years continuous overcharge provides essentially the same discharge curve as the initial one.

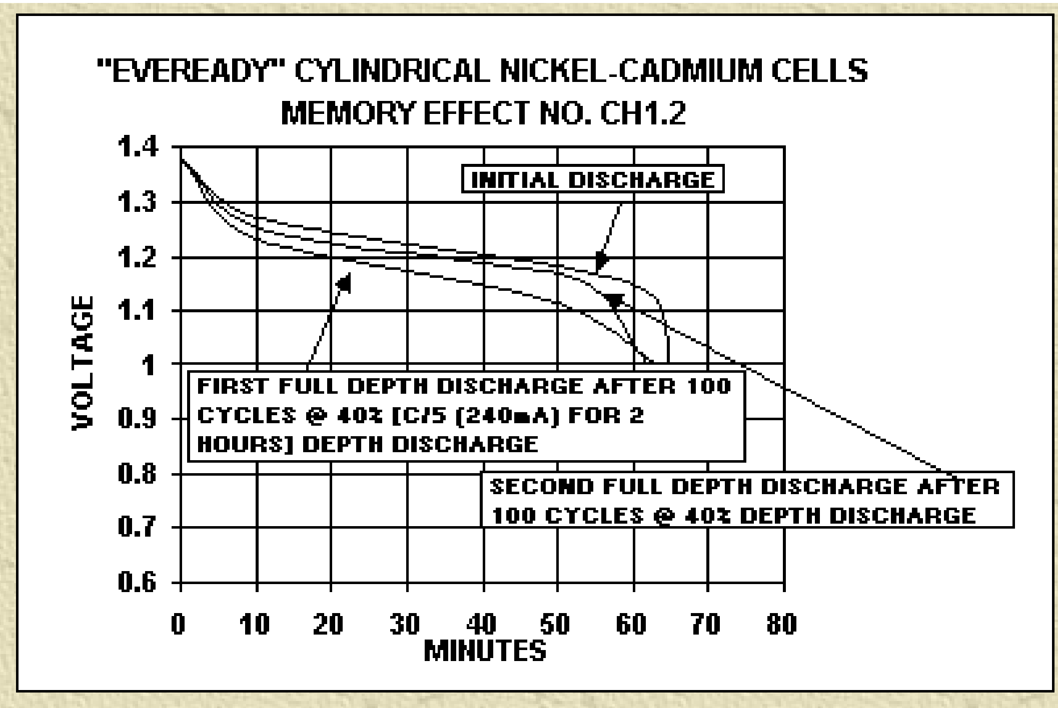




The chart above illustrates maintenance vs. months of continuous overcharge at the 20 hour rate with periodic discharges every 3 months at the 1 hour rate. The cells maintain 90% of their initial capacity after 2 years of this overcharge regimen. This pattern of use would occur if batteries are left on charge continuously and used one cycle only on an occasional basis.

Memory Effect

Memory effect is that characteristic attributed to nickel-cadmium cells wherein the cell retains the characteristics of the previous cycling. That is, after repeated shallow depth discharges the cell will fail to provide a satisfactory full depth discharge. Energizer cylindrical nickel-cadmium cells are particularly excellent with regard to lack of memory effect. The chart below depicts initial and subsequent cycles after repeated shallow discharges. The graphs show the initial discharge curve and the first and second discharge curves after 100 cycles @ 40% depth of discharge. You will note that the subsequent full depth discharges yield nearly equal capacity to the initial curve at slightly reduced voltage levels.



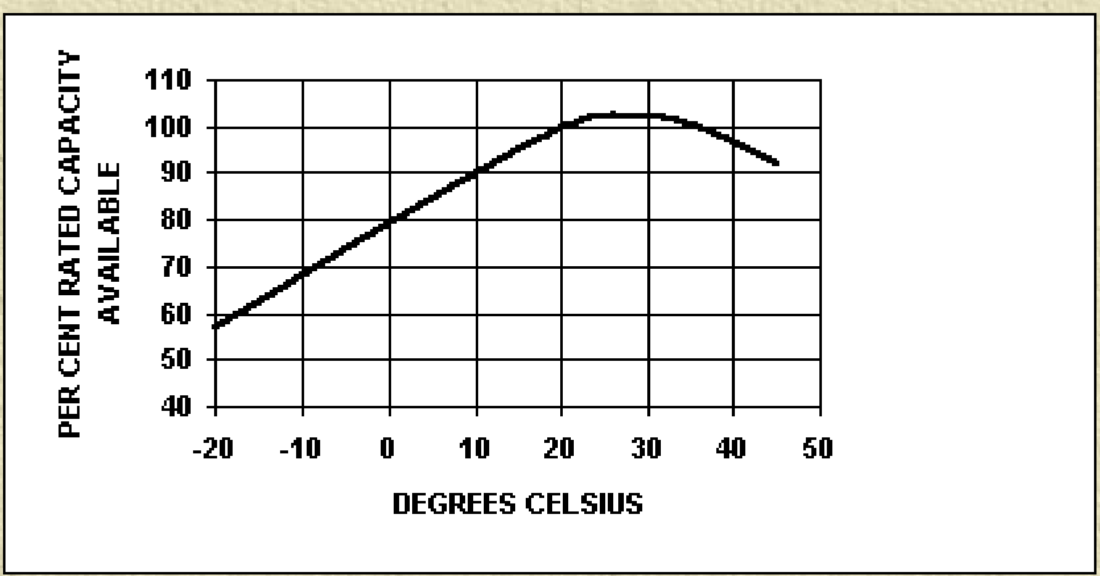
Storage

At elevated storage temperatures self-discharge will be considerably higher than at room temperature. It is recommended that batteries be stored at 21°C (70°F) or lower for this reason.

Temperature Characteristics

"Eveready" sealed nickel-cadmium cells experience a relatively small change of output capacity over a wide range of operating temperature.   Charging, however, must be done in a much narrower range. Temperature limits applicable to operation of the cells are listed in the specification sheets for each battery.

The capacity vs. temperature curves which are on some individual specification sheets represent cells discharged at the temperatures shown after charging at room temperature for 14 hours at the 10 hour rate. This characteristic is also generalized on the following curve.



Charging nickel cadmium cells below the recommended temperature can cause oxygen pressure build up and activation of the resealable safety vent. Multiple vent activations will reduce cell capacity.

Effect of high and low temperatures on storage, discharging and charging of Energizer Nickel-Cadmium cells and batteries

	Low Temperature	**High Temperature**
Storage (All Types)	at - 40°C (-40°F) No detrimental effect. However, cells or batteries should be allowed to return to room temperature prior to charging.	at 60°C (140°F) No detrimental effect. However,, self-discharge is more rapid starting at 32°C (90°F) and increases as temperature is further elevated.
Discharge (All Types)	at - 20°C (-4°F) No detrimental effect but capacity will be reduced.	at 45°C (113°F) No detrimental effect.
Charge		
(7 -10 hour rate)	at 0°C (32°F) Cells or batteries should not be charged below 0°C (32°F) at the 7 - 10 hour rate.	at 45°C (113°F) Cells or batteries evidence charge acceptance of approximately 50%.
(1 to 3 hour rate)	at 15°C (60°F) Cells or batteries should not be charged below 15°C (60°F) at the 1 hour rate or below 10°C (50°F) at the 3 hour rate.	at 45°C (113°F) Cells or batteries evidence charge acceptance of approximately 90%.

Impedance and Internal Resistance

Sealed nickel-cadmium cells have a high effective capacitance. Their impedance is so low that cells which, in effect, are being continuously overcharged, make excellent ripple filters.

Cell impedance is dependent upon frequency and state of charge of the cell. It is lower for a charged cell than it is for a discharged cell. Values of impedance and resistance are shown on the individual specification sheets for each cell.

Internal resistance (R_e) is calculated using the voltage drop method as described in ANSI C18.2, which states that a fully charged cell rated at less than 5Ah shall be discharged at $10.0C_1$A(capacity rating at 1 hour rate in terms of amps) for 2 minutes then and switched to $1.0C_1$A. The voltage shall be recorded just prior to switching and again upon reaching its maximum value after switching. The effective internal resistance, R_e shall be calculated as indicated below:

$R_e = \dfrac{\Delta V}{\Delta I}$ where $\Delta V = V_L - V_H$ and $\Delta I = I_H - I_L$

Notations: R_e = Internal Resistance

ΔV = Voltage Change
ΔI = Current Change
V_L = Voltage recorded after switching
V_H = Voltage recorded prior to switching
I_L = Current recorded after switching
I_H = Current recorded prior to switching

For 50% discharged cells, multiply R_e by 1.2 factor.

Cycle Life

Cycle life of the nickel-cadmium sealed cell depends both upon cell design and the type of use in which it is subjected. Excepting violent abuse, the use factors which most seriously influence life expectancy are:

- Amount of overcharge (excessive overcharge is undesirable)
- Temperature of charge and overcharge (elevated or lowered temperature is undesirable)
- Endpoint requirements regarding rate and capacity (increased cycle life will ordinarily be the result of a shallow discharge regimen).

Any treatment which causes a cell to vent is harmful. Frequent or extended venting of even properly valved cells eventually destroys them.

In rating cycle life, end of life of the sealed nickel-cadmium cell is considered to be when it no longer provides 80% of its rated capacity. If a cell can be considered to be satisfactory while delivering less than the 80% endpoint figure, cycle life will be greater than that listed. The ratings are for 21°C (70°F) performance.

Charging

Constant current charging is recommended for sealed nickel-cadmium cells. The 10 hour rate should not be exceeded unless overcharge is specifically to be prevented. The recharge efficiency of sealed nickel-cadmium cell is dependent on a number of things, but it is most important to remember that charging becomes more difficult as temperature increases and charge rate decreases.

It is possible, under certain conditions, to charge at rates much higher than the 10 hour rate, but control devices which prevent high rate over-charge are sometimes required.

The nickel-cadmium battery can be trickle charged but floating and constant voltage charging are not recommended. For maximum performance in situations of long term trickle charge current required to keep the battery fully charged is approximately the 30-50 hour rate plus whatever is necessary to compensate for any major withdrawals.

Technical Background Information

This "Eveready" battery construction provides practical high rate charging with minimum cost and weight for control circuitry. Control concepts make use of the fact that, in the nickel-cadmium cell system, the cell will heat if charging continues after the electrodes reach full charge. The cell has been designed to exhibit sufficient temperature rise to effect charge control without a significant change in operating pressure. The "Eveready" Fast Charge cell series develops the desired temperature rise, and has the built-in ability to withstand short term overcharge at rates to one hour values without physical damage or loss in cell capacity. The cell construction is specifically designed to withstand overcharge at the three hour rate without special control circuitry. Considerable heat can be generated within the cell, however, if overcharge is extended beyond a reasonable period of time. To prevent this heat from causing gradual cell degradation, it is recommended that the cell temperature not exceed 46°C(115°F) during this extended overcharge and that the cells be removed from the charger within two or three days of reaching full charge.

Prior to this construction, any cell overcharged at the one hour rate would be permanently damaged. This "Eveready" Fast Charge cell can withstand overcharge at these high rates long enough for the temperature rise to be sensed by simple control elements. This temperature rise is very pronounced, and provides a positive signal for charge control. As a result, the control element can be small, lightweight and inexpensive.

Sealed secondary nickel-cadmium cells have been manufactured for many years based on the so-called "oxygen recombination" principle. The charge-accepting capacity of the negative electrode is made to exceed the charge-accepting capacity of the positive electrode. Upon charging, the positive electrode reaches a state of full charge before the negative electrode and oxygen is evolved at the positive electrode. The oxygen gas reacts or combines with the active cadmium metal on the surfaces of the negative electrode. Thus, recombination of oxygen prevents the buildup of an excessive internal gas pressure.

In charging nickel-cadmium cells, an overcharge, i.e., ampere-hours input which is in excess of that previously removed upon discharge, must be provided to insure that the cells have reached full charge. If overcharge is continued at too high a rate of charge current, the evolved oxygen gas may not fully recombine, consequently a build up of excessive internal gas pressure may result. A safety resealable vent is provided to limit excessive build up of pressure. The proper selection of the electrolyte volume controls oxygen recombination pressure below the safety vent opening pressure.

The safe charge rate for sealed secondary nickel-cadmium cells for extended charge periods has been established at the ten hour, or the C/10 rate. Capacity (c) is the rated ampere-hour capacity of the cell and 10 is the number of hours required at perfect charge efficiency to bring a completely discharged cell to full charge. At the 10 hour rate and lower currents, an equilibrium condition is maintained in the cell and consequently there is no excessive build up of internal gas pressure.

Energizer sealed secondary nickel-cadmium cells and batteries are now widely used as a rechargeable power source in many different types of portable or cordless electric appliances. Charging at the safe recommended 7 to 10 hour rate has proven satisfactory for recharging the cells or batteries used in many of these appliances, such as tooth brushes, shavers, etc. where relatively long rest periods between uses are possible. However, there is now a demand for use of sealed nickel-cadmium cells and batteries in other appliances such as chain saws, electronic flash, portable drills, professional hair clippers, etc. where the rest periods between uses of the appliances are much shorter and consequently shorter recharging times, from about 3 hour to about 1 hour, i.e. C/3 to C/1 rate, are required.

To accomplish charge termination safely and reliably, temperature sensing has required fast-acting, precise and expensive equipment at the lower charge rates. Because of the size, cost and complexity of such a system, the thermal sensing approach to overcharge control heretofore has been impractical for the consumer oriented nickel-cadmium battery powered portable appliances and devices.

The Energizer Fast Charge cell has been specially designed to withstand high rate overcharge and thus to overcome the above mentioned drawbacks.

The Energizer Fast Charge cell exhibits a relatively sharp rise in temperature during high rate overcharge. The particular type of thermal sensor to be used in combination with the cell or battery and the charger system is not critical. Probably the least expensive overall cell or battery control unit is provided by use of a simple snap-action thermostatic switch. The snap-action thermostatic switch combines the temperature sensing and circuit switching functions in one small, inexpensive device which can be easily attached to the cell or battery.

A solid-state thermistor sensor may also be used. The thermistor is also relatively inexpensive and even more compact, although it performs only the function of a sensor. Auxiliary circuitry and switching means are required to cut off the charging current in response to the thermistor input. Among the commercially available types of thermistors, the positive temperature coefficient type is preferred because it changes resistance abruptly at a predetermined temperature. Auxiliary circuitry is thereby simplified without loss of reliability.

In constructing individual cell or battery units, it is not critical that the thermal sensor be placed or maintained in actual physical contact with the cell proper, although this is preferred. Individual cell units may be constructed with a small flat disc-type thermostatic switch welded in contact with the bottom of the cell. Similar battery units may be constructed with a small thermistor or bimetallic switch placed in the space between adjoining cells. Any arrangement is satisfactory providing the thermal sensor is well exposed to the heat generated by the individual cell or one or more cells of the battery. The use of extensive heat sinks, such as placing the entire battery in a water bath, is not recommended since this can prevent heat build up, impede oxygen recombination within the cell and lead to cell venting before sufficient heat rise occurs.

The terminal leads from the thermal sensor may be connected to additional external contacts or may be brought out from the cell or battery unit and connected directly into the circuit. Where a sensor-switch device is used in a series-connected battery, it may be preferred to wire the switch internally between two series cells so that no additional external contacts are required. The practicality of this connection depends upon discharge current value and sensor current rating. The advantage would be that the circuit would also open on discharge in case the battery becomes overheated for any reason.

The charger circuit required for charging the individual cell or battery is not unique. A constant current type charger is recommended with due regard for heat dissipation and wattage ratings of all components.

Back to Top of Page

Nickel Cadmium Batteries
Application Manual

The nickel-cadmium battery is a remarkable device. More than fifty years of successful use has proved this point. Nickel-cadmium batteries may be recharged many times and have a relatively constant potential during discharge. They will stand more electrical and physical abuse than any other cell, have good low temperature performance characteristics, and are more than competitive with other systems in terms of cost per hour of use. They are true storage batteries using one of the very best electrochemical systems.

"Eveready" Sealed Nickel-cadmium Cells

The nickel-cadmium cell has been used in Europe for many years in its original form, as a vented or unsealed cell. Technological advances have made possible the extension of the nickel-cadmium system to small hermetically sealed batteries-rechargeable batteries that are free of the usual routine maintenance, such as the addition of water. These developments have brought the economic advantages of rechargeability to small batteries.

"Eveready" sealed nickel-cadmium cells can be recharged many times to give long useful life, and are not adversely affected by standing many months, either charged or discharged.

These high quality batteries, when used within their recommended ratings and in applications where the use of rechargeable cells is justified, will provide economical, trouble-free service. New portable devices requiring more energy than is economically available from ordinary primary batteries are practical with this complete line of rechargeable batteries.

Applications

"Eveready" sealed nickel-cadmium batteries are ideally suited for use in many types of battery-operated equipment. Some of the many applications are listed here:

- Calculators
- Cassette players and recorders
- Dictating machines
- Digital Cameras
- Instruments
- Personal Pagers
- Photoflash equipment

- Portable communications equipment
- Portable hand tools and appliances
- Portable computers
- Radios
- Radio control models
- Shavers
- Tape recorders
- Television sets
- Toothbrushes

Operation of the Sealed Nickel-Cadmium Battery

Any secondary cell is a combination of active materials which can be electrolytically oxidized and reduced repeatedly. The oxidation of the negative electrode occurring simultaneously with the reduction of the positive generates electric power. In a rechargeable battery both electrode reactions are reversible and the input of current in the proper direction from an outside source will drive the primary or discharge reaction backwards and in effect recharge the electrodes.

In the uncharged condition the positive electrode of a nickel-cadmium cell is nickelous hydroxide, the negative cadmium hydroxide. In the charged condition the positive electrode is nickelic hydroxide, the negative metallic cadmium. The electrolyte is potassium hydroxide. The average operating voltage of the cell under normal discharge conditions is about 1.2 volts. The over-all chemical reaction of the nickel-cadmium system can be considered as:

(Charged) KOH (Discharged)

$$Cd + 2NiOOH + 2H_2O \Leftrightarrow Cd(OH)_2 + 2Ni(OH)_2$$

During the latter part of a recommended charge cycle and during overcharge, nickel-cadmium batteries generate gas. Oxygen is generated at the positive (nickel) electrode after it becomes fully charged and hydrogen is formed at the negative (cadmium) electrode when it reaches full charge.

These gases must be vented from the conventional nickel-cadmium system. In order for the system to be overchargeable while sealed, the evolution of hydrogen must be prevented and provisions made for this reaction of oxygen within the cell container. These things are accomplished by the following:

- The battery is constructed with excess capacity in the cadmium electrode.
- Starting with both electrodes fully discharged, charging the battery causes the positive electrode to reach full charge first and it starts oxygen generation. Since the negative (cadmium) electrode has not reached full charge hydrogen will not be generated.

- The cell is designed so that the oxygen formed in the positive electrode can reach the metallic cadmium surface of the negative electrode which it oxidizes directly.
- Thus, in overcharge, the cadmium electrode is oxidized at a rate just sufficient to offset input energy, keeping the cell in equilibrium indefinitely. At this point of equilibrium the positive electrode is fully charged and the negative is somewhat less than fully charged.

Polarity Reversal:

When cells are connected in series and discharged completely, small cell capacity differences will cause one cell to reach complete discharge sooner than the remainder. The cell which reaches full discharge first will be driven into reverse by the others. When this happens in an ordinary nickel-cadmium sealed cell, oxygen will be evolved at the cadmium electrode and hydrogen at the nickel electrode. Gas pressure will increase as long as current is driven through the cell and eventually it will either vent or burst. This condition is prevented in some sealed nickel-cadmium cells by special construction features. These include the use of a reducible material in the positive in addition to the nickel hydroxide, to suppress hydrogen evolution when the positive expires. If cadmium oxide is used it is possible to prevent hydrogen formation and to react the oxygen formed at the negative by same basic process used to regulate pressure during overcharge.

A cell is considered electrochemically protected against reversal of polarity if, after discharge at the 10 hour rate down to 1.1 volts, it may receive an additional 5 hour discharge with the same current without being damaged or otherwise affected. "Eveready" cylindrical cells are protected against cell rupture, caused by gassing generated during polarity reversal, by a pressure relief vent.

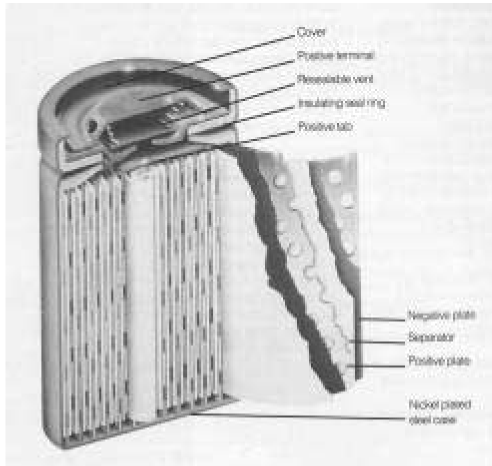
Energizer Sealed Nickel-Cadmium Rechargeable Batteries

Energizer nickel-cadmium cells are available in cylindrical configuration and range in capacity up to 5 Amp hours in sizes from AAA to D.

Cylindrical Cells

This cell type incorporates a different electrode arrangement than the button cell. Sintered plates are used in all cylindrical cells for the positive electrode. This electrode consists of thin, highly porous nickel plaques impregnated with active materials. The plaque is made by heating nickel powder in an inert atmosphere until the particles are welded together. The metallic phase serves as a highly conductive supporting structure for the electrode. The structure of the plate is such that a large surface is furnished for reaction of the active materials. With the sintered electrode it is possible to build cells of very low internal resistance.

The negative electrode of most Energizer cylindrical cells is a pasted electrode which consists of blended active materials pressed onto a metal carrier. It is this electrode that gives Energizer cylindrical nickel-cadmium cells outstanding cycle life, long term overcharge capability, with essentially no fade and with little or no memory effect.



Sealed nickel-cadmium cells under certain abuse conditions such as excessive charge or overcharge rate, deep discharge with subsequent polarity reversal, may develop high internal gas pressure. Usually the gas is oxygen, although hydrogen is also evolved in some cases. Either or both hydrogen and oxygen must be vented.

All Energizer high rate cylindrical cells have a resealing pressure vent. This vent permits the cell to release excess gas evolved if the cell, for example, is abused. When the internal pressure has dropped to an acceptable level, the vent will reseal, permitting the cell to be recycled in the normal manner with little or no further loss of electrolyte or capacity. Repeated venting will reduce capacity and cycle life.

Contact Material

External electrical connections can be made with any good conductor having adequate current handling capabilities.

Potting

Nickel-cadmium cells or batteries of any type should not be totally potted. Energizer cells have resealable vent mechanisms which wold be rendered inoperative by the potting compound.

Electrical Characteristics

Energizer sealed nickel-cadmium cells exhibit relatively constant discharge voltages. They can be recharged many times for long lasting economical power. They are small convenient packages of high energy output, hermetically sealed in steel cases, leak resistant and will operate in any position. The cells have very low internal resistance and impedance, are rugged and highly resistant to shock and vibration.

The temperature range under which these cells may be operated is wide. Use at high temperatures, however, or charging at higher than recommended rates, or repeated discharge beyond the normal cutoffs may be harmful.

Capacity

The capacity rating of Energizer nickel-cadmium cells and batteries is based upon output in discharge at the 1 hour rate to an endpoint of 1.0V/cell for all cylindrical cells. If current is withdrawn at faster rates than these standards, capacity is decreased.

Paralleling of Cells

"Eveready" sealed nickel-cadmium cells should not be charged in parallel unless each cell or series string of the parallel circuit has its own current limiting resistor. Minor differences in internal resistance of the cells may result, after cycling, in extreme variation in their states of charge. This may lead to overcharge at excessive currents in some cells and undercharge in other cells.

Voltage Characteristics

Except in the case of complete discharge, neither cell condition nor state of charge can be determined by open circuit voltage. Within a short while after charging it may be above 1.4 volts. It will fall shortly thereafter to 1.35V and continue to drop as the cell loses charge.

During discharge, the average voltage of a sealed nickel-cadmium battery is approximately 1.2 volts per cell. At normal discharge rates the characteristic is very nearly flat until the cell approaches complete discharge. The battery provides most of its energy above 1.0 volt per cell. If the cell is discharged with currents exceeding the rated value, however, the voltage characteristic will have more of a slope, a lower endpoint voltage will be necessary and the ampere hours per cycle will be reduced.

High Current Pulse Discharge

High rate nickel-cadmium cells will deliver exceedingly high currents. If they are discharge continuously under short circuit conditions, self-heating may do irreparable damage.

The heat problems vary somewhat from one cell type to another, but in most cases internal metal strip tab connectors overheat or the electrolyte boils. In some instances both events occur.

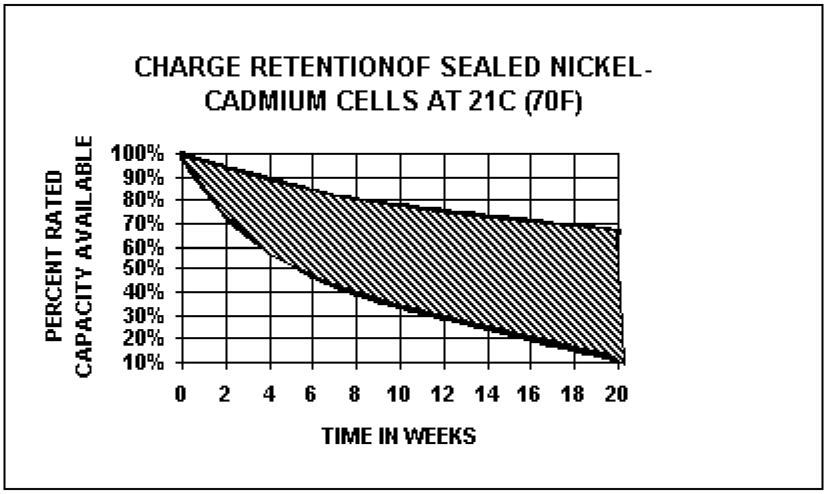
General overheating is normally easy to prevent because the outside temperature of the battery can be used to indicate when rest, for cooling, is required. In terms of cutoff temperature during discharge, it is acceptable practice to keep the battery always below $45^{o}C$ ($113^{o}F$).

The overheated internal connectors are difficult to detect. This form of overheating takes place in a few seconds or less, and overall cell temperature may hardly be affected. It is thus advisable to withdraw no more ampere seconds per pulse, and to withdraw it at no greater average current per complete discharge, than recommended on the data sheet for the "Eveready" cell in question. In special cases, where cooling of the cell or battery is likely to be poor, or unusually good, special tests should be run to check the important temperatures before any duty cycle adjustment is made.

Output capacity is any discharge composed of pulses is difficult to predict accurately because there are infinite combinations of current, "on" time, rest time, and end point voltage. Testing on a specific cycle is the simplest way to get a positive answer.

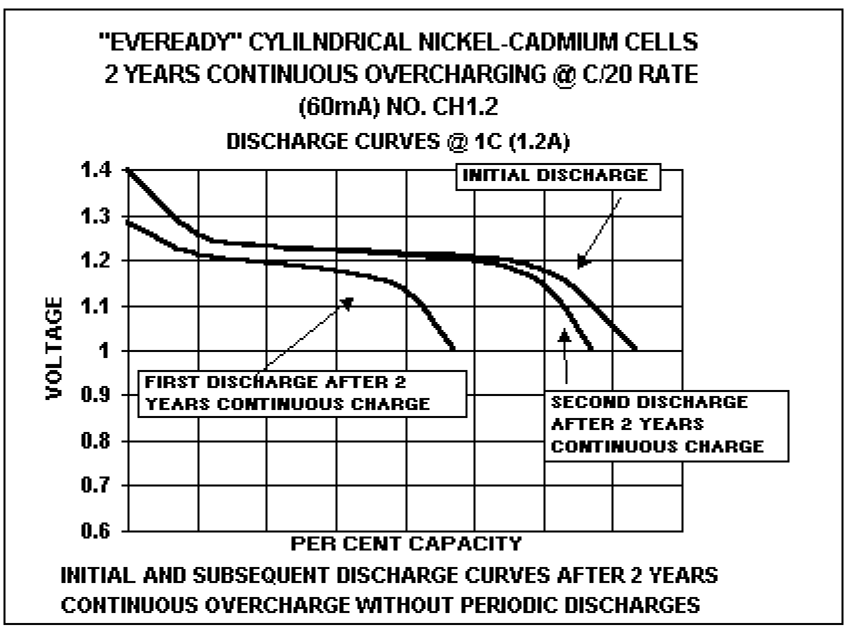
Self-Discharge

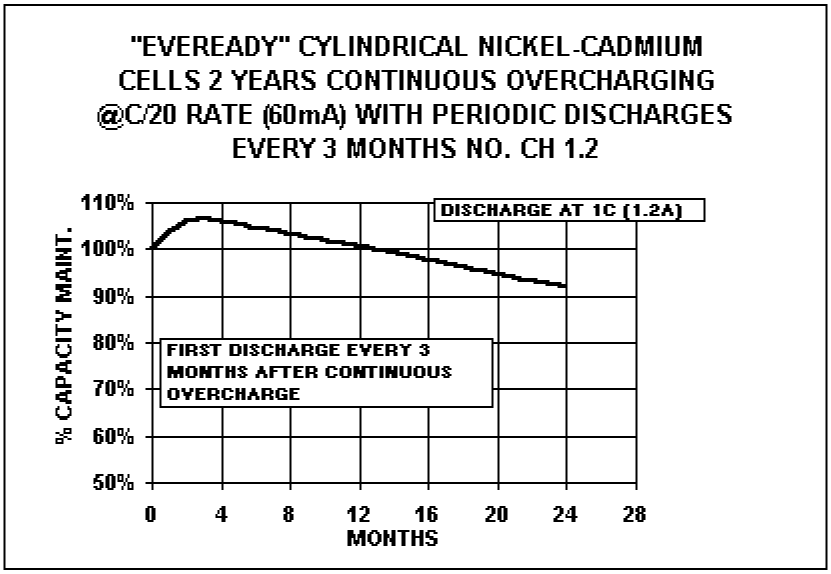
Self-discharge characteristics of Energizer nickel-cadmium cells are shown in the chart below. The characteristics are shown as a decline in percent of rated capacity available. Self-discharge is increased by elevated temperatures. Batteries are not harmed even if not used for long periods of time.



Continuous Overcharge

The overcharge capability of Energizer cylindrical nickel-cadmium cells is outstanding. The next chart illustrates initial and subsequent discharge curves after 2 years continuous overcharge without periodic discharges. The first discharge after the 2 year charge period yields a slightly reduced voltage curve and 65% capacity. The second cycle after 2 years continuous overcharge provides essentially the same discharge curve as the initial one.

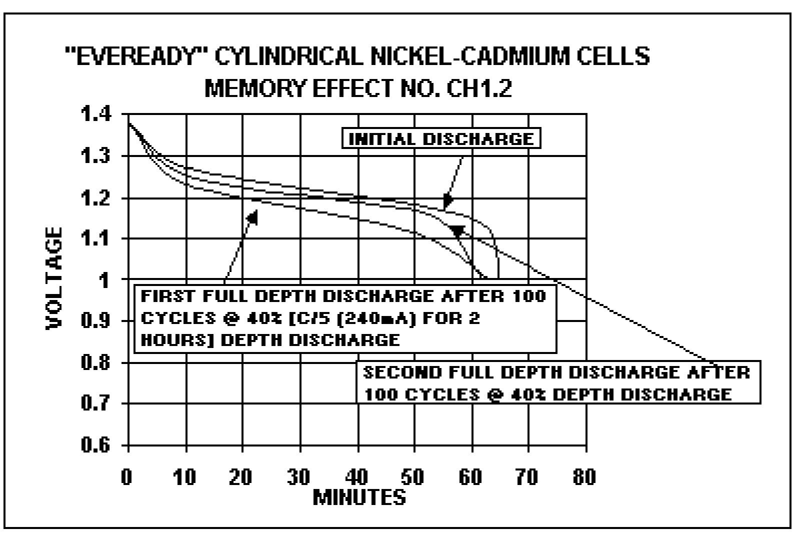




The chart above illustrates maintenance vs. months of continuous overcharge at the 20 hour rate with periodic discharges every 3 months at the 1 hour rate. The cells maintain 90% of their initial capacity after 2 years of this overcharge regimen. This pattern of use would occur if batteries are left on charge continuously and used one cycle only on an occasional basis.

Memory Effect

Memory effect is that characteristic attributed to nickel-cadmium cells wherein the cell retains the characteristics of the previous cycling. That is, after repeated shallow depth discharges the cell will fail to provide a satisfactory full depth discharge. Energizer cylindrical nickel-cadmium cells are particularly excellent with regard to lack of memory effect. The chart below depicts initial and subsequent cycles after repeated shallow discharges. The graphs show the initial discharge curve and the first and second discharge curves after 100 cycles @ 40% depth of discharge. You will note that the subsequent full depth discharges yield nearly equal capacity to the initial curve at slightly reduced voltage levels.



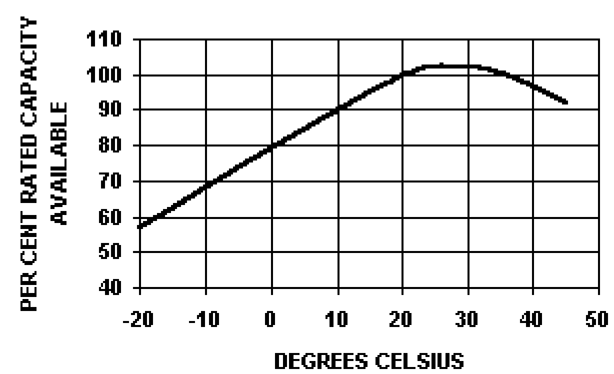
Storage

At elevated storage temperatures self-discharge will be considerably higher than at room temperature. It is recommended that batteries be stored at 21°C (70°F) or lower for this reason.

Temperature Characteristics

"Eveready" sealed nickel-cadmium cells experience a relatively small change of output capacity over a wide range of operating temperature. Charging, however, must be done in a much narrower range. Temperature limits applicable to operation of the cells are listed in the specification sheets for each battery.

The capacity vs. temperature curves which are on some individual specification sheets represent cells discharged at the temperatures shown after charging at room temperature for 14 hours at the 10 hour rate. This characteristic is also generalized on the following curve.



Charging nickel cadmium cells below the recommended temperature can cause oxygen pressure build up and activation of the resealable safety vent. Multiple vent activations will reduce cell capacity.

Effect of high and low temperatures on storage, discharging and charging of Energizer Nickel-Cadmium cells and batteries

	Low Temperature	**High Temperature**
Storage (All Types)	at - 40°C (-40°F) No detrimental effect. However, cells or batteries should be allowed to return to room temperature prior to charging.	at 60°C (140°F) No detrimental effect. However,, self-discharge is more rapid starting at 32°C (90°F) and increases as temperature is further elevated.

Discharge (All Types)	at - 20°C (-4°F) No detrimental effect but capacity will be reduced.	at 45°C (113°F) No detrimental effect.
Charge		
(7 -10 hour rate)	at 0°C (32°F) Cells or batteries should not be charged below 0°C (32°F) at the 7 - 10 hour rate.	at 45°C (113°F) Cells or batteries evidence charge acceptance of approximately 50%.
(1 to 3 hour rate)	at 15°C (60°F) Cells or batteries should not be charged below 15°C (60°F) at the 1 hour rate or below 10°C (50°F) at the 3 hour rate.	at 45°C (113°F) Cells or batteries evidence charge acceptance of approximately 90%.

Impedance and Internal Resistance

Sealed nickel-cadmium cells have a high effective capacitance. Their impedance is so low that cells which, in effect, are being continuously overcharged, make excellent ripple filters.

Cell impedance is dependent upon frequency and state of charge of the cell. It is lower for a charged cell than it is for a discharged cell. Values of impedance and resistance are shown on the individual specification sheets for each cell.

Internal resistance (R_e) is calculated using the voltage drop method as described in ANSI C18.2, which states that a fully charged cell rated at less than 5Ah shall be discharged at $10.0C_1A$(capacity rating at 1 hour rate in terms of amps) for 2 minutes then and switched to $1.0C_1A$. The voltage shall be recorded just prior to switching and again upon reaching its maximum value after switching. The effective internal resistance, R_e shall be calculated as indicated below:

$$R_e = \frac{DV}{D\,I} \text{ where } DV = V_L - V_H \text{ and } D\,I = I_H - I_L$$

Notations: R_e = Internal Resistance
DV = Voltage Change
D I = Current Change
V_L = Voltage recorded after switching
V_H = Voltage recorded prior to switching
I_L = Current recorded after switching
I_H = Current recorded prior to switching

For 50% discharged cells, multiply R_e by 1.2 factor.

Cycle Life

Cycle life of the nickel-cadmium sealed cell depends both upon cell design and the type of use in which it is subjected. Excepting violent abuse, the use factors which most seriously influence life expectancy are:

- Amount of overcharge (excessive overcharge is undesirable)
- Temperature of charge and overcharge (elevated or lowered temperature is undesirable)
- Endpoint requirements regarding rate and capacity (increased cycle life will ordinarily be the result of a shallow discharge regimen).

Any treatment which causes a cell to vent is harmful. Frequent or extended venting of even properly valved cells eventually destroys them.

In rating cycle life, end of life of the sealed nickel-cadmium cell is considered to be when it no longer provides 80% of its rated capacity. If a cell can be considered to be satisfactory while delivering less than the 80% endpoint figure, cycle life will be greater than that listed. The ratings are for 21°C (70°F) performance.

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Constant current charging is recommended for sealed nickel-cadmium cells. The 10 hour rate should not be exceeded unless overcharge is specifically to be prevented. The recharge efficiency of sealed nickel-cadmium cell is dependent on a number of things, but it is most important to remember that charging becomes more difficult as temperature increases and charge rate decreases.

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Back to Index Printer Friendly Version

Energizer Miniature Lithium Batteries

Table of Contents:

A FEW WORDS ABOUT LITHIUM BATTERIES

Why choose lithium batteries over the other battery systems?

The most significant advantages of lithium batteries are long (10 + year estimated) shelf life at room temperature, good low temperature operation, high operating voltage and excellent leakage resistance. In many cases this battery can become a permanent component for the lifetime of your equipment. Many "Eveready" lithium batteries have Underwriters Laboratories' Component Recognition (see data pages for specific types)

Following is information on lithium battery systems available to you today from "Energizer".

FEATURES OF "Energizer" LITHIUM BATTERIES:

- High energy density
- High voltage
- Long shelf life
- Wide temperature range for operation and storage
- Underwriters Labs (UL) component recognition for selected types
- Leak resistant
- Small size
- Suitable for pulse discharge
- Ideal standby power source
- May be used in any position

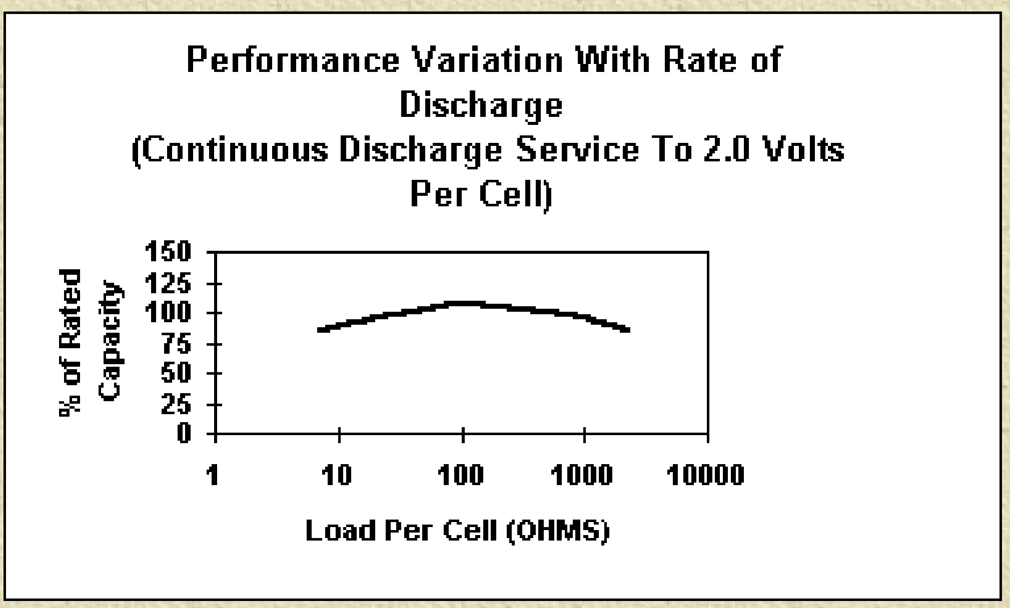
TYPICAL APPLICATIONS FOR LITHIUM BATTERIES

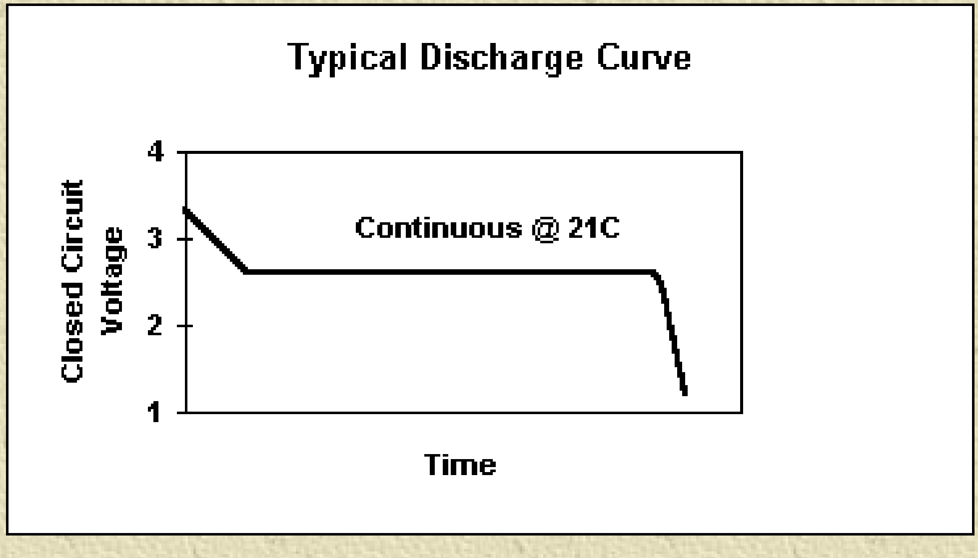
- Audio Equipment
- Calculators
- Cameras & Light Meters
- Data Acquisition Systems
- Electronic Communication Devices
- Electronic Games

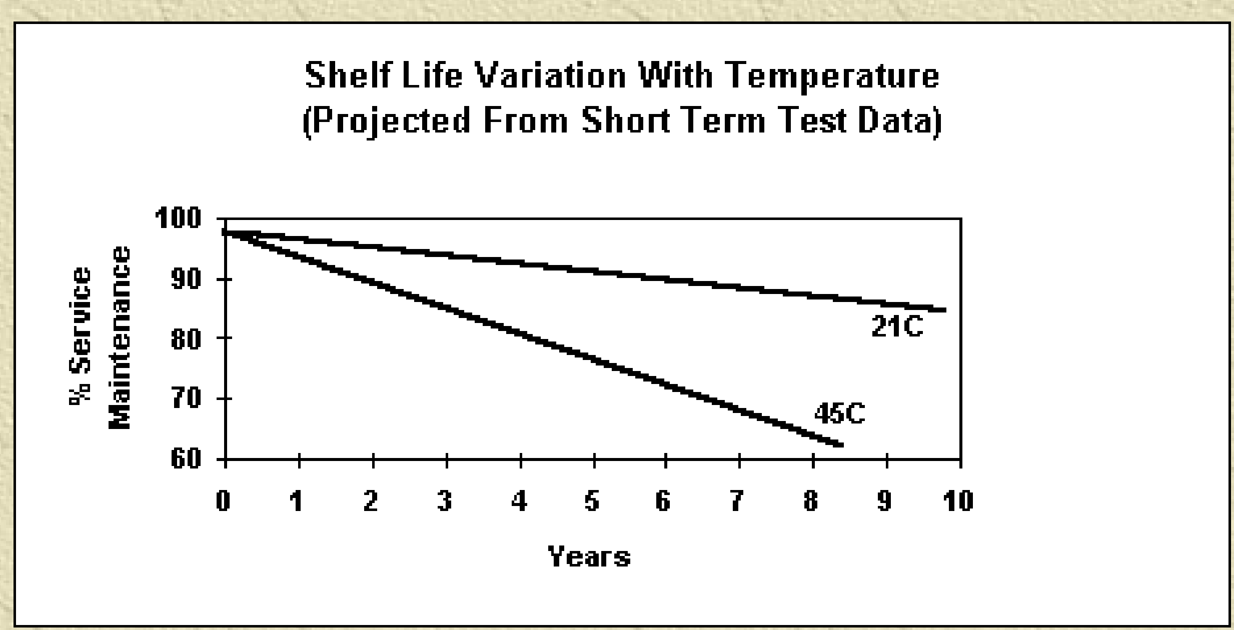
- Electronic Wristwatches & Clocks
- Hearing Aids
- Industrial Monitors/Controls
- Medical Equipment
- Memory Retention
- Micro Cassette Recorders
- Military Electronics
- Remote Keyless Entry
- Security Devices
- Small Electronic Instruments
- Switchboards
- Transceivers & Radios

LITHIUM MANGANESE DIOXIDE SYSTEM
(Li/MnO_2) **MINIATURE**

Operating Temperature Range -40°C to +60°C
Max. Recommended Wave Soldering Time: 2 Sec.







This reference manual contains general information on all Energizer/Eveready batteries within the Lithium chemical system in production at the time of preparation of the manual. Since the characteristics of individual batteries are sometimes modified, persons and businesses that are considering the use of a particular battery should contact the nearest Energizer Sales Office for current information. None of the information in the manual constitutes a representation or warranty by Eveready Battery Company, Inc. concerning the specific performance or characteristics of any of the batteries or devices.

Back to Top of Page

Eveready Battery Company, Inc.

533 Maryville University Drive
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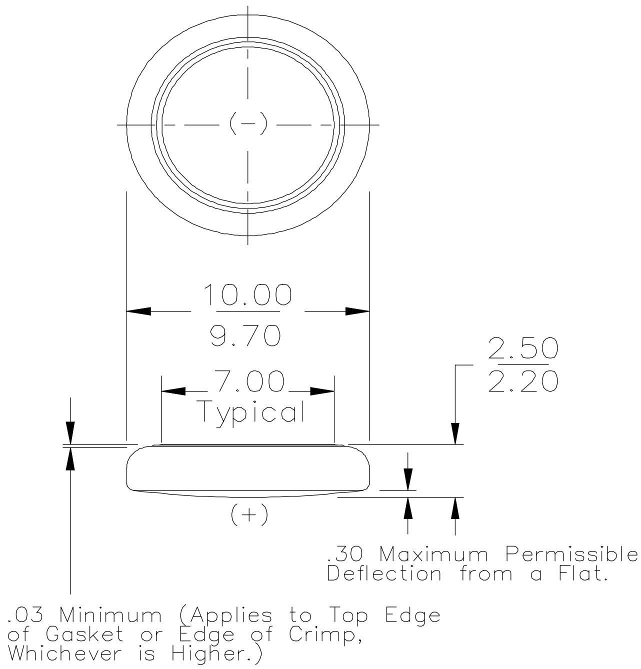
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CR1025

Dimensions (mm)



Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

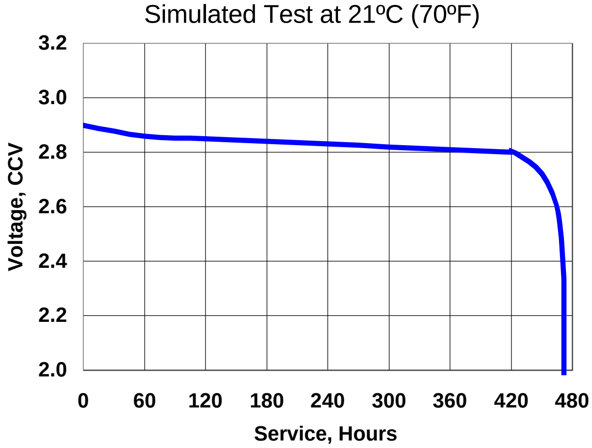
Designation: ANSI / NEDA-5033LC, IEC-CR1025
Battery Voltage: 3 Volts
Average Weight: 0.7 grams (0.02 oz.)
Volume: 0.2 cubic centimeters (0.1 cubic inch)
Average Service capacity (to 2.0 Volts): 30 mAh
(Rated capacity at 45K ohms at 21ºC)
Energy Density: 124 milliwatt hr/g, 435 milliwatt hr/cc

Millimeters	Inches
0.03	0.001
0.30	0.012
2.20	0.087
2.50	0.098
7.00	0.276
9.70	0.382
10.00	0.394

SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.9V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V hours
24 hours / day	64	45,000	467

Typical DischargeCharacteristics
Simulated Test at 21ºC (70ºF)



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Home Primary Recharg. Glossary Comments Site Map

Back to Lithium Miniature Table

Energizer

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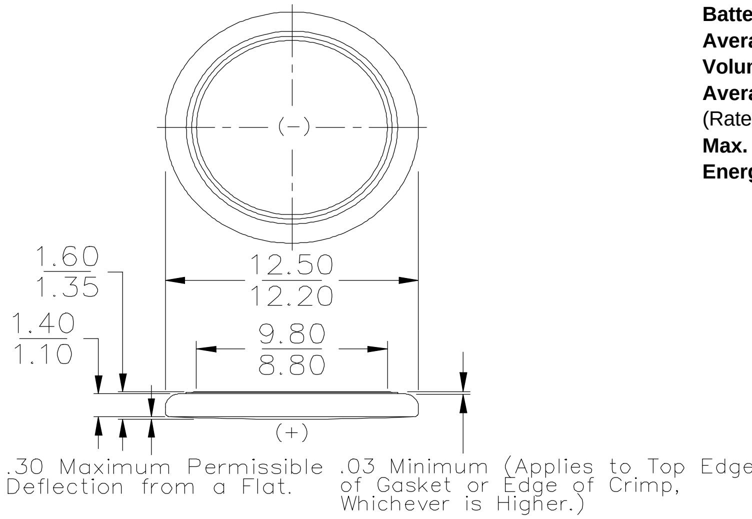
Engineering Data

ENERGIZER NO. CR1216

Dimensions (mm)



Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

Designation: ANSI / NEDA-5034LC, IEC-CR1216
Battery Voltage: 3 Volts
Average Weight: 0.7 grams (0.02 oz.)
Volume: 0.2 cubic centimeters (0.01 cubic inch)
Average Service capacity (to 2.0 Volts): 29 mAh
(Rated capacity at 45K ohms at 21ºC)
Max. Reverse Charging Current: 1 microampere
Energy Density: 118 milliwatt hr/g, 413 milliwatt hr/cc

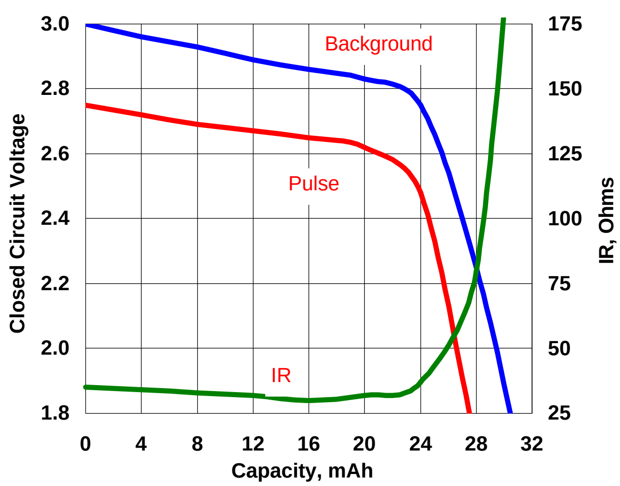
Millimeters	Inches
0.03	0.001
0.30	0.012
1.10	0.043
1.35	0.053
1.40	0.055
1.60	0.063
8.80	0.346
9.80	0.386
12.20	0.480
12.50	0.492

INTERNAL RESISTANCE CHARACTERISTICS
Pulse Test at 21ºC (70ºF)

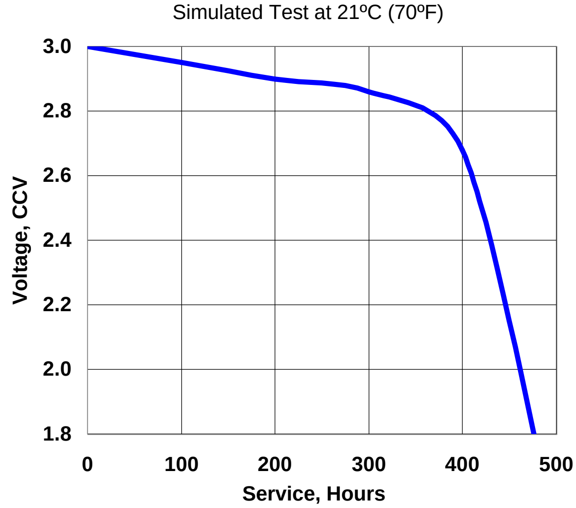
Schedule: Continuous for background
2 seconds X 12 times/day for pulse
Typical Background Drain @ 2.9V (milliamps):
0.63 milliamperes
Typical Pulse Drain @ 2.6V (milliamps):
7.00 milliamperes
Background Load:
45k ohms
Pulse Load:
400 ohms

SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.85V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V hours
24 hours / day	63	45,000	467



Typical DischargeCharacteristics
Simulated Test at 21ºC (70ºF)



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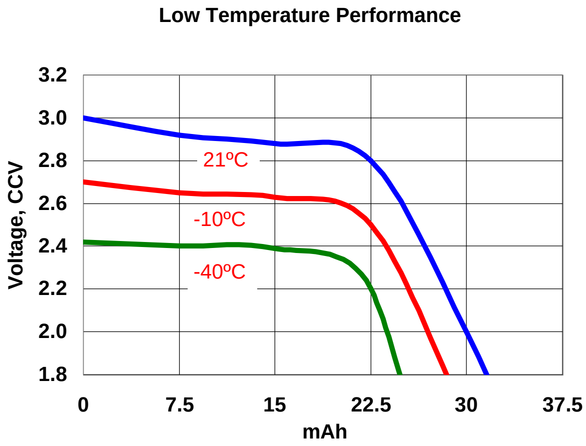
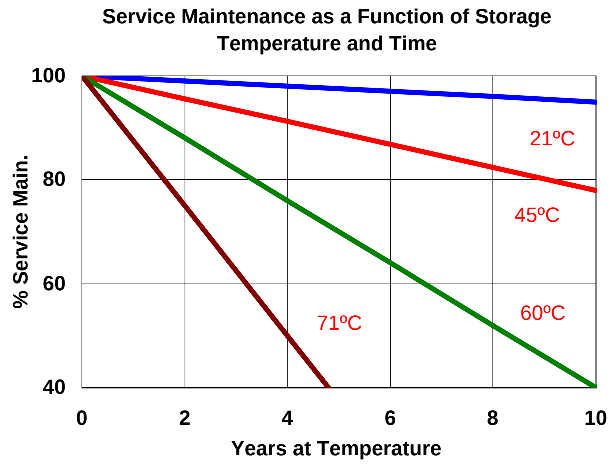
Form No. EBC - 4112C





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Home | Primary | Recharg. | Glossary | Comments | Site Map

Back to Lithium Miniature Table

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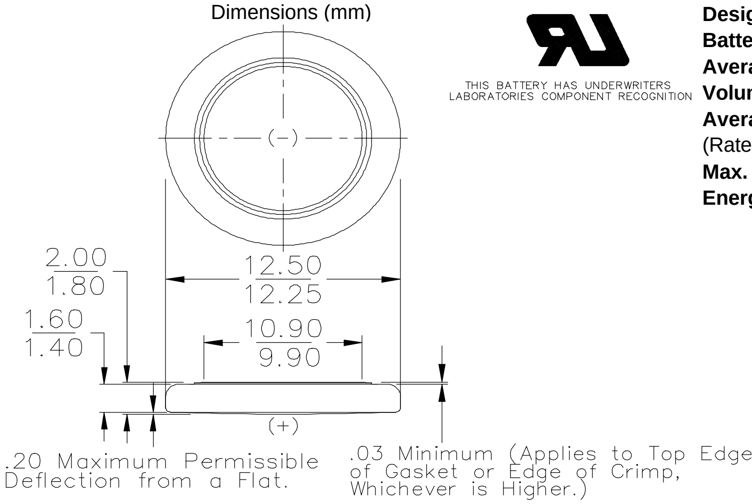
Engineering Data

ENERGIZER NO. CR1220

Dimensions (mm)



Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

Designation: ANSI / NEDA-5012LC, IEC-CR1220
Battery Voltage: 3 Volts
Average Weight: 0.76 grams (0.03 oz.)
Volume: 0.25 cubic centimeters (0.02 cubic inch)
Average Service capacity (to 2.0 Volts): 40 mAh
(Rated capacity at 45K ohms at 21ºC)
Max. Reverse Charging Current: 1 microampere
Energy Density: 153 milliwatt hr/g, 464 milliwatt hr/cc

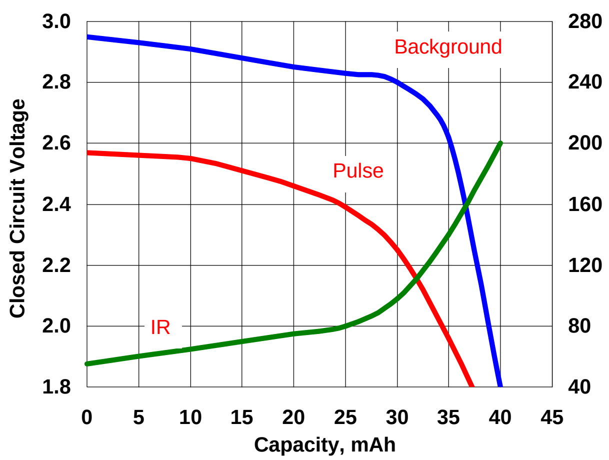
Millimeters	Inches
0.03	0.001
0.20	0.008
1.40	0.055
1.60	0.063
1.80	0.071
2.00	0.079
9.90	0.390
10.90	0.429
12.25	0.482
12.50	0.492

INTERNAL RESISTANCE CHARACTERISTICS
Pulse Test at 21ºC (70ºF)

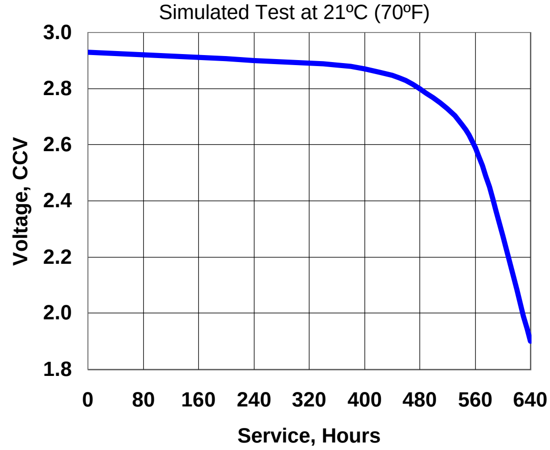
Schedule: Continuous for background
2 seconds X 12 times/day for pulse
Typical Background Drain @ 2.9V (milliamps):
0.064 milliamperes
Typical Pulse Drain @ 2.6V (milliamps):
6.30 milliamperes
Background Load:
45k ohms
Pulse Load:
400 ohms

SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.9V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V hours
24 hours / day	64	45,000	628



Typical DischargeCharacteristics
Simulated Test at 21ºC (70ºF)



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Back to Lithium Miniature Table

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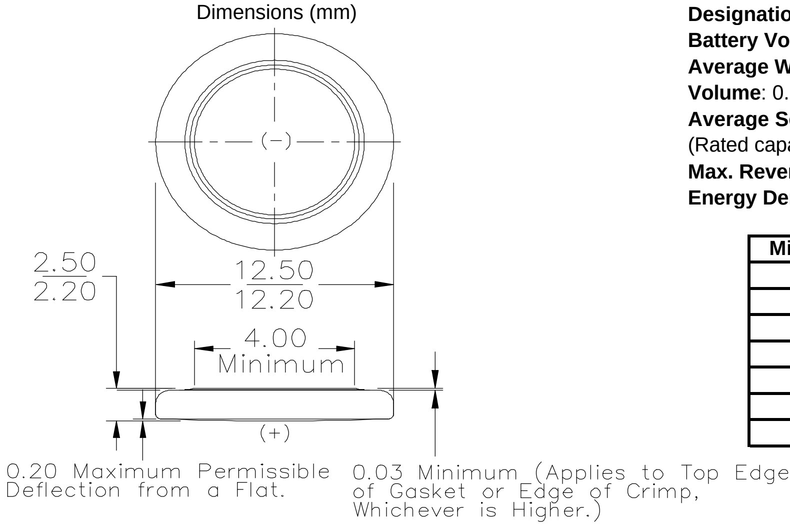
Engineering Data

ENERGIZER NO. CR1225

Dimensions (mm)



Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

Designation: ANSI / NEDA-5020LC, IEC-CR1225
Battery Voltage: 3 Volts
Average Weight: 0.9 grams (0.03 oz.)
Volume: 0.28 cubic centimeters (0.02 cubic inch)
Average Service capacity (to 2.0 Volts): 50 mAh
(Rated capacity at 45K ohms at 21ºC)
Max. Reverse Charging Current: 1 microampere
Energy Density: 161 milliwatt hr/g, 518 milliwatt hr/cc

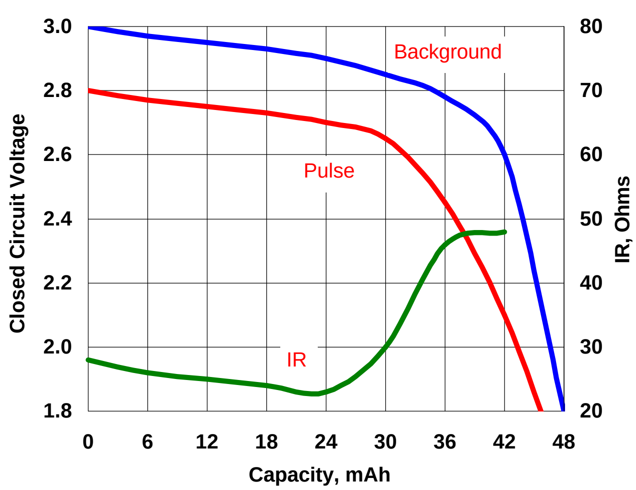
Millimeters	Inches
0.03	0.001
0.20	0.008
2.20	0.087
2.50	0.098
4.00	0.157
12.20	0.480
12.50	0.492

INTERNAL RESISTANCE CHARACTERISTICS
Pulse Test at 21ºC (70ºF)

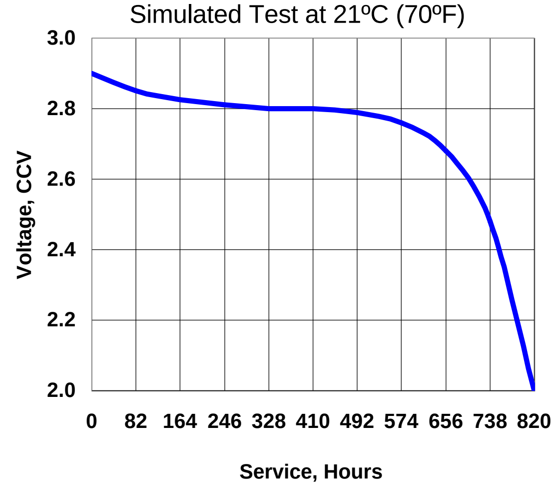
Schedule: Continuous for background
2 seconds X 12 times/day for pulse
Typical Background Drain @ 2.9V (milliamps):
0.064 milliamperes
Typical Pulse Drain @ 2.6V (milliamps):
6.30 milliamperes
Background Load:
45k ohms
Pulse Load:
400 ohms

SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.9V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V hours
24 hours / day	64	45,000	817



Typical DischargeCharacteristics
Simulated Test at 21ºC (70ºF)



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Back to Lithium Miniature Table

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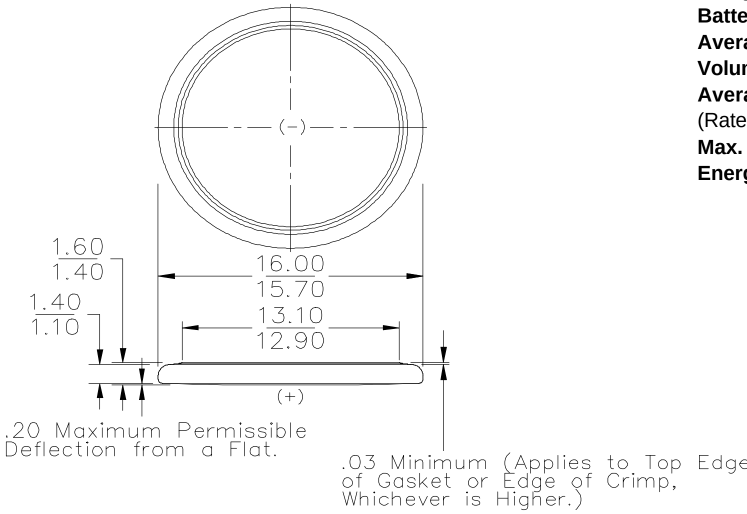
Engineering Data

ENERGIZER NO. CR1616

Dimensions (mm)



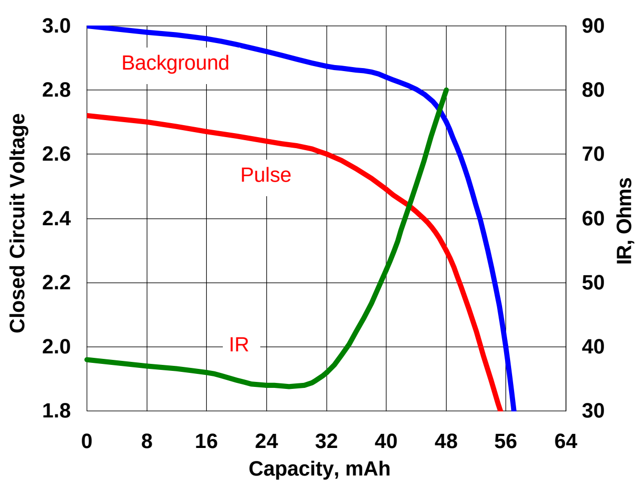
Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

Designation: ANSI / NEDA-5021LC, IEC-CR1616
Battery Voltage: 3 Volts
Average Weight: 1.2 grams (0.04 oz.)
Volume: 0.32 cubic centimeters (0.02 cubic inch)
Average Service capacity (to 2.0 Volts): 55 mAh
(Rated capacity at 30K ohms at 21ºC)
Max. Reverse Charging Current: 1 microampere
Energy Density: 133 milliwatt hr/g, 498 milliwatt hr/cc

Millimeters	Inches
0.03	0.001
0.20	0.008
1.10	0.043
1.40	0.055
1.60	0.063
12.90	0.508
13.10	0.516
15.70	0.618
16.00	0.630

INTERNAL RESISTANCE CHARACTERISTICS
Pulse Test at 21ºC (70ºF)

Schedule: Continuous for background
2 seconds X 12 times/day for pulse
Typical Background Drain @ 2.9V (milliamps):
0.097 milliamperes
Typical Pulse Drain @ 2.6V (milliamps):
6.50 milliamperes
Background Load:
30k ohms
Pulse Load:
400 ohms

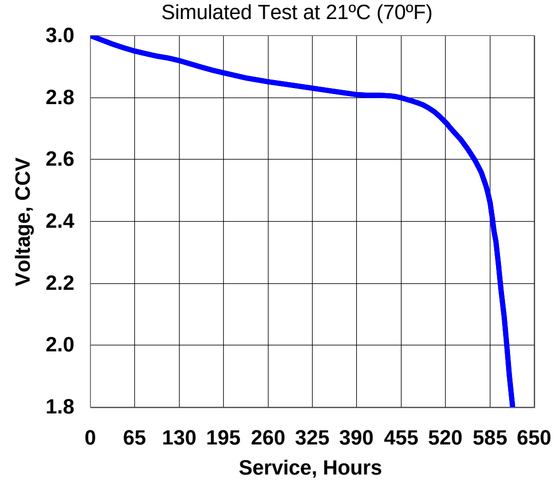


SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.9V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V
			hours
24 hours / day	97	30,000	610

Typical DischargeCharacteristics

Simulated Test at 21ºC (70ºF)



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Energizer

Home | Primary | Recharg. | Glossary | Comments | Site Map

Back to Lithium Miniature Table

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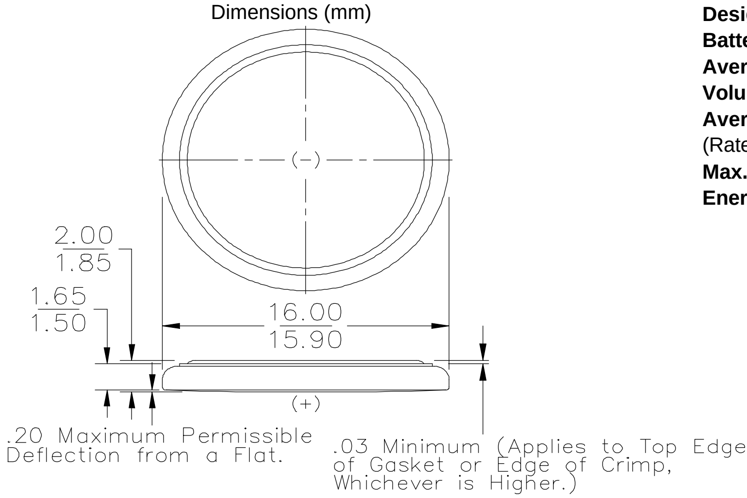
Engineering Data

ENERGIZER NO. CR1620

Dimensions (mm)



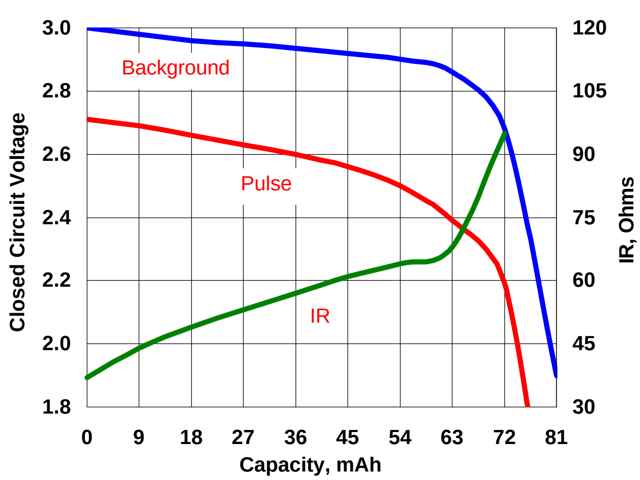
Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

Designation: ANSI / NEDA-5009LC, IEC-CR1620
Battery Voltage: 3 Volts
Average Weight: 1.4 grams (0.05 oz.)
Volume: 0.4 cubic centimeters (0.02 cubic inch)
Average Service capacity (to 2.0 Volts): 79 mAh
(Rated capacity at 30K ohms at 21ºC)
Max. Reverse Charging Current: 1 microampere
Energy Density: 164 milliwatt hr/g, 573 milliwatt hr/cc

Millimeters	Inches
0.03	0.001
0.20	0.008
1.50	0.059
1.65	0.065
1.85	0.073
2.00	0.079
15.90	0.626
16.00	0.630

INTERNAL RESISTANCE CHARACTERISTICS
Pulse Test at 21ºC (70ºF)

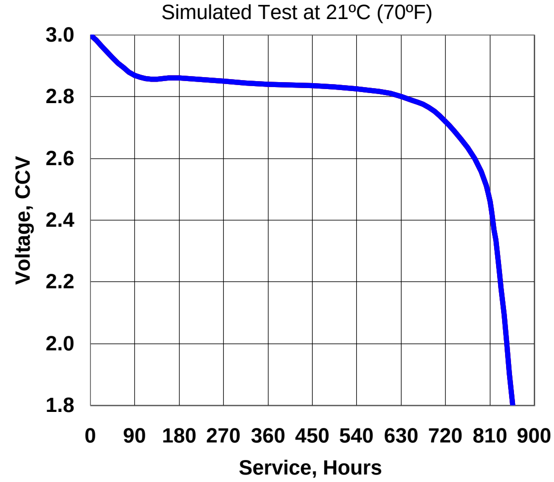
Schedule: Continuous for background
2 seconds X 12 times/day for pulse
Typical Background Drain @ 2.9V (milliamps):
0.097 milliamperes
Typical Pulse Drain @ 2.6V (milliamps):
6.80 milliamperes
Background Load:
30k ohms
Pulse Load:
400 ohms



SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.9V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V hours
24 hours / day	97	30,000	851

Typical DischargeCharacteristics
Simulated Test at 21ºC (70ºF)



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Form No. EBC - 4116B

Home | Primary | Recharg. | Glossary | Comments | Site Map

Back to Lithium Miniature Table

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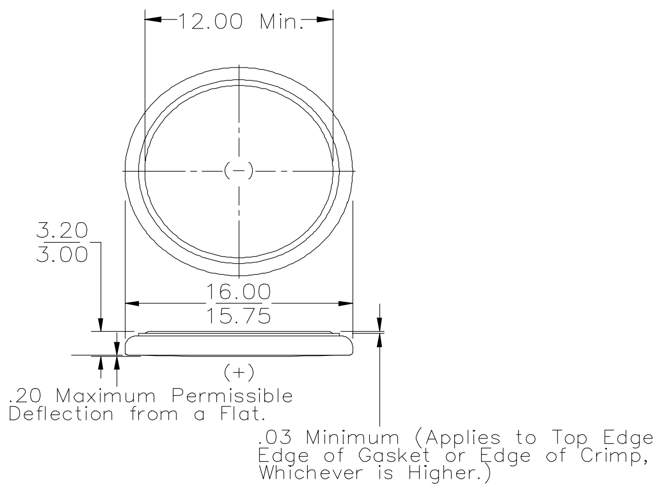
Engineering Data

ENERGIZER NO. CR1632

Dimensions (mm)



Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

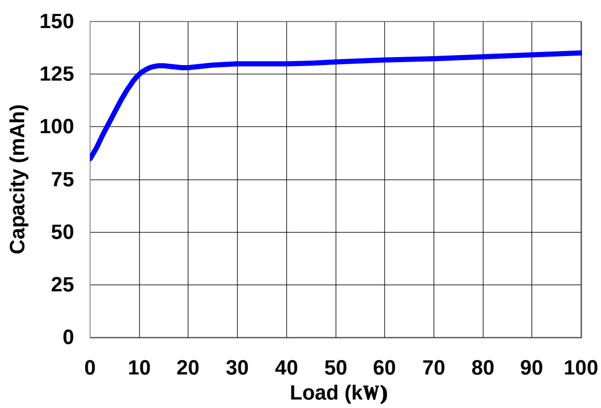
Battery Voltage: 3 Volts
Average Weight: 1.8 grams
Volume: 0.5 cubic centimeters (0.03 cubic inch)
Average Service capacity (to 2.0 Volts): 130 mAh
(Rated capacity at 15K ohms at 21ºC)
Terminals: Flat Contacts
Energy Density: 209 milliwatt hr/g, 754 milliwatt hr/cc

Millimeters	Inches
0.03	0.001
0.20	0.008
3.00	0.118
3.20	0.126
12.00	0.472
15.75	0.620
16.00	0.630

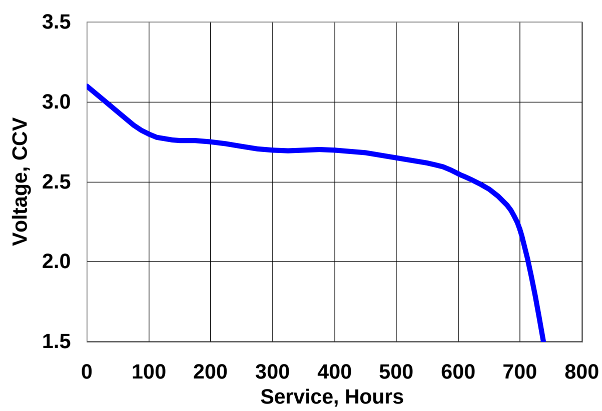
SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.9V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V
			hours
24 hours / day	**190**	**15,000**	**710**

Typical Capacity Characteristics
Simulated test at 21ºC (70ºF)



Typical Discharge Characteristics
Simulated test at 21ºC (70ºF) Load: 15kΩ



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Form No. EBC - 4126A

Home | Primary | Recharg. | Glossary | Comments | Site Map

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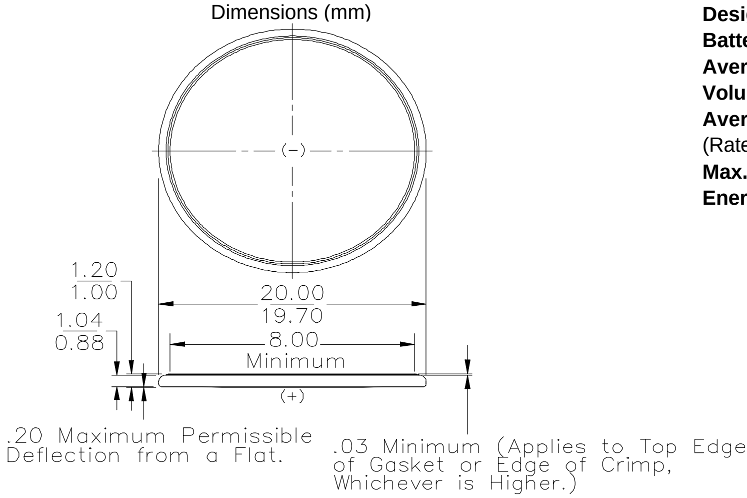
Engineering Data

ENERGIZER NO. CR2012

Dimensions (mm)



Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

Designation: IEC-CR2012
Battery Voltage: 3 Volts
Average Weight: 1.3 grams (0.04 oz.)
Volume: 0.3 cubic centimeters (0.02 cubic inch)
Average Service capacity (to 2.0 Volts): 58 mAh
(Rated capacity at 30K ohms at 21ºC)
Max. Reverse Charging Current: 1 microampere
Energy Density: 129 milliwatt hr/g, 561 milliwatt hr/cc

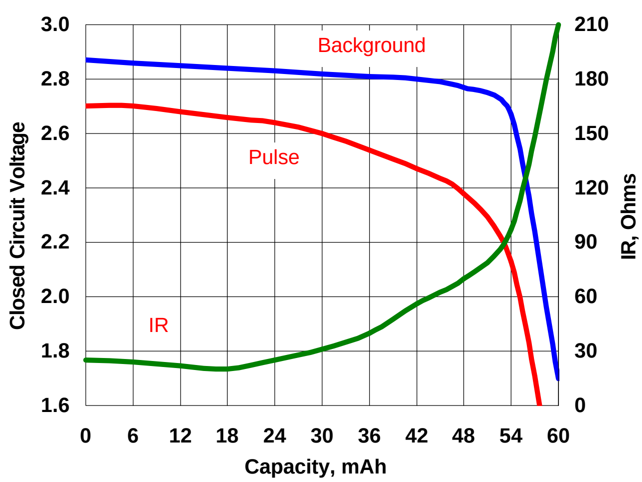
Millimeters	Inches
0.03	0.001
0.20	0.008
0.88	0.035
1.00	0.039
1.04	0.041
1.20	0.047
8.00	0.315
19.70	0.776
20.00	0.787

INTERNAL RESISTANCE CHARACTERISTICS
Pulse Test at 21ºC (70ºF)

Schedule: Continuous for background
2 seconds X 12 times/day for pulse
Typical Background Drain @ 2.9V (milliamps):
0.097 milliamperes
Typical Pulse Drain @ 2.6V (milliamps):
6.80 milliamperes
Background Load:
30k ohms
Pulse Load:
400 ohms

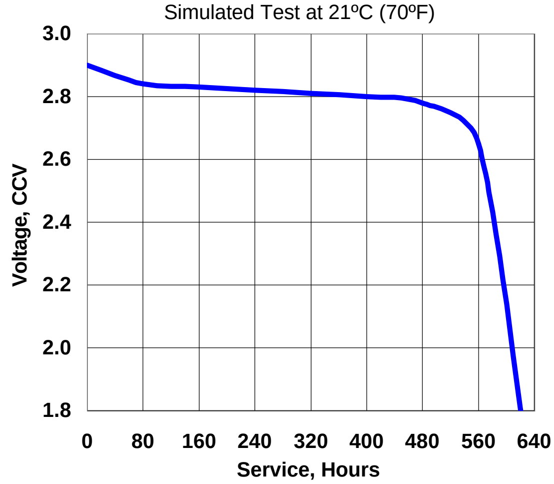
SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.9V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V
			hours
24 hours / day	97	30,000	613



Typical DischargeCharacteristics

Simulated Test at 21ºC (70ºF)



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Home | Primary | Recharg. | Glossary | Comments | Site Map

Back to Lithium Miniature Table

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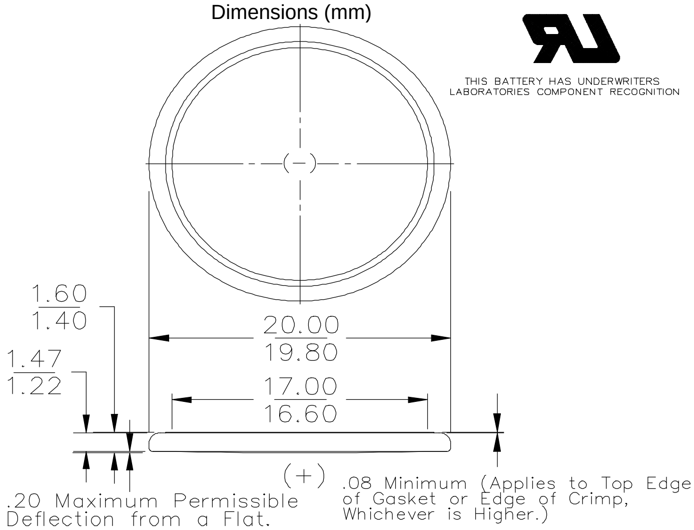
Engineering Data

ENERGIZER NO. CR2016

Dimensions (mm)



Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

Designation: ANSI / NEDA-5000LC, IEC-CR2016
Battery Voltage: 3 Volts
Average Weight: 1.9 grams (0.07 oz.)
Volume: 0.5 cubic centimeters (0.03 cubic inch)
Average Service capacity (to 2.0 Volts): 80 mAh
(Rated capacity at 30K ohms at 21ºC)
Max. Reverse Charging Current: 1 microampere
Energy Density: 122 milliwatt hr/g, 464 milliwatt hr/cc

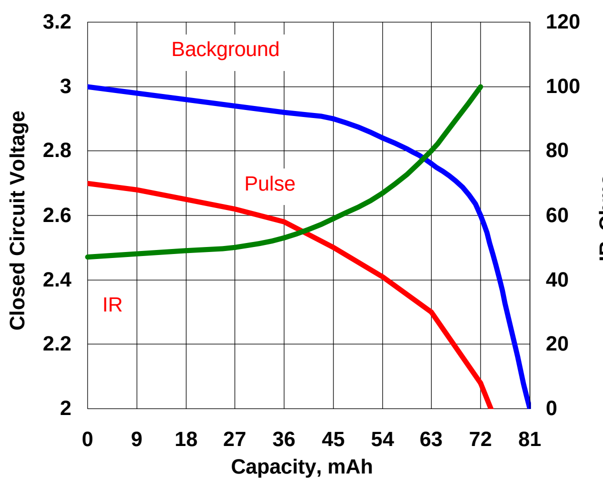
Millimeters	Inches
0.08	0.003
0.20	0.008
1.22	0.048
1.40	0.055
1.47	0.058
1.60	0.063
16.60	0.654
17.70	0.697
20.00	0.787

INTERNAL RESISTANCE CHARACTERISTICS
Pulse Test at 21ºC (70ºF)

Schedule: Continuous for background
2 seconds X 12 times/day for pulse
Typical Background Drain @ 2.9V (milliamps):
0.97 milliamperes
Typical Pulse Drain @ 2.6V (milliamps):
6.50 milliamperes
Background Load:
30k ohms
Pulse Load:
400 ohms

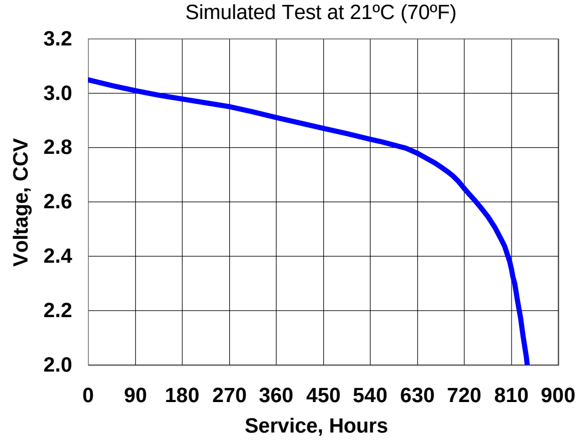
SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.9V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V
			hours
24 hours / day	6	500,000	13,800
24 hours / day	97	30,000	830
24 hours / day	2,900	1,000	25
Estimated Average Service at -30ºC (-22ºF)			
24 hours / day	83	30,000	680



Typical DischargeCharacteristics

Simulated Test at 21ºC (70ºF)



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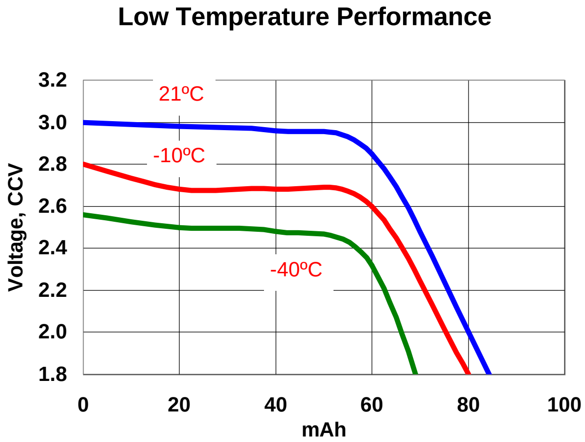

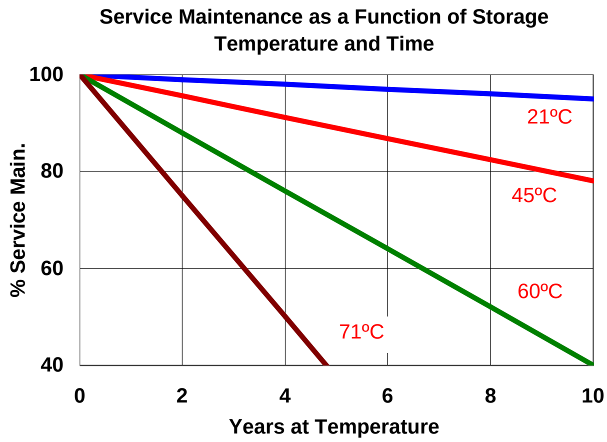

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Home | Primary | Recharg. | Glossary | Comments | Site Map

Back to Lithium Miniature Table

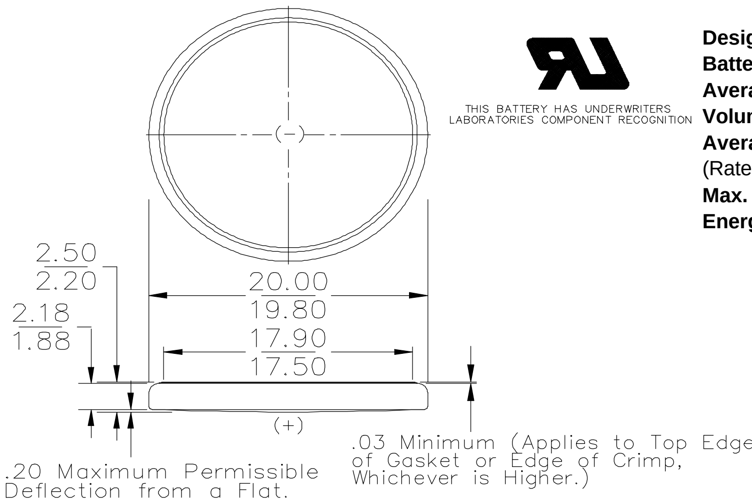
Eveready Battery Company, Inc.

533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CR2025

THIS BATTERY HAS UNDERWRITERS LABORATORIES COMPONENT RECOGNITION



Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

Designation: ANSI / NEDA-5003LC, IEC-CR2025
Battery Voltage: 3 Volts
Average Weight: 2.8 grams (0.10 oz.)
Volume: 0.8 cubic centimeters (0.05 cubic inch)
Average Service capacity (to 2.0 Volts): 170 mAh
(Rated capacity at 15K ohms at 21ºC)
Max. Reverse Charging Current: 1 microampere
Energy Density: 176 milliwatt hr/g, 616 milliwatt hr/cc

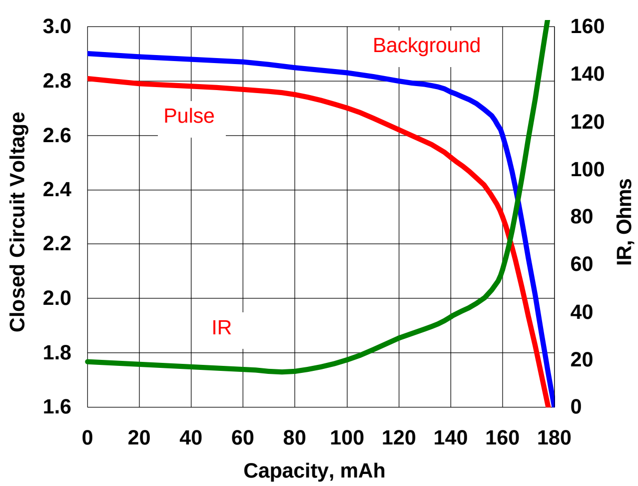
Millimeters	Inches
0.03	0.001
0.20	0.008
1.88	0.074
2.18	0.086
2.20	0.087
2.50	0.098
17.50	0.689
17.90	0.705
19.80	0.780
20.00	0.787

INTERNAL RESISTANCE CHARACTERISTICS
Pulse Test at 21ºC (70ºF)

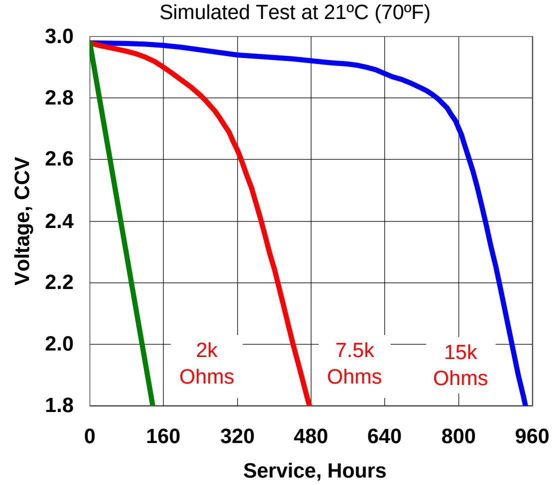
Schedule: Continuous for background
2 seconds X 12 times/day for pulse
Typical Background Drain @ 2.9V (milliamps):
0.19 milliamperes
Typical Pulse Drain @ 2.6V (milliamps):
7.00 milliamperes
Background Load:
15k ohms
Pulse Load:
400 ohms

SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.9V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V hours
24 hours / day	**193**	**15,000**	**925**
24 hours / day	**386**	**7,500**	**450**
24 hours / day	**1,450**	**2,000**	**120**
24 hours / day	**2,900**	**1,000**	**60**



Typical DischargeCharacteristics
Simulated Test at 21ºC (70ºF)



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Back to Lithium Miniature Table

Energizer

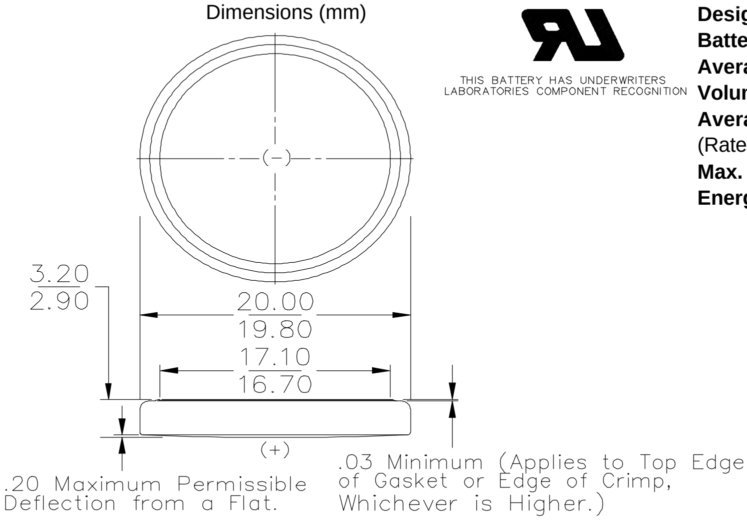
Eveready Battery Company, Inc.

533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CR2032

Dimensions (mm)



THIS BATTERY HAS UNDERWRITERS LABORATORIES COMPONENT RECOGNITION

Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

Designation: ANSI / NEDA-5004LC, IEC-CR2032
Battery Voltage: 3 Volts
Average Weight: 3.3 grams (0.12 oz.)
Volume: 1.0 cubic centimeters (0.06 cubic inch)
Average Service capacity (to 2.0 Volts): 225 mAh
(Rated capacity at 10K ohms at 21ºC)
Max. Reverse Charging Current: 1 microampere
Energy Density: 198 milliwatt hr/g, 653 milliwatt hr/cc

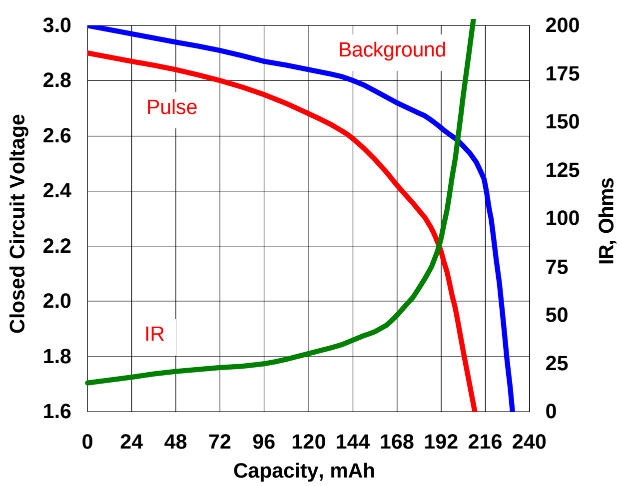
Millimeters	Inches
0.03	0.001
0.20	0.008
2.90	0.114
3.20	0.126
16.70	0.657
17.10	0.673
19.80	0.780
20.00	0.787

INTERNAL RESISTANCE CHARACTERISTICS
Pulse Test at 21ºC (70ºF)

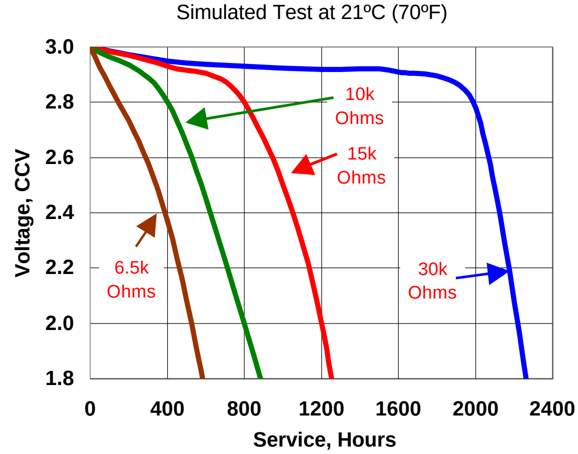
Schedule: Continuous for background
2 seconds X 12 times/day for pulse
Typical Background Drain @ 2.9V (milliamps):
0.295 milliamperes
Typical Pulse Drain @ 2.6V (milliamps):
7.3 milliamperes
Background Load:
10k ohms
Pulse Load:
400 ohms

SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.9V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V hours
24 hours / day	**97**	**30,000**	**2,250**
24 hours / day	**193**	**15,000**	**1,184**
24 hours / day	**290**	**10,000**	**800**
24 hours / day	**440**	**6,500**	**511**



Typical DischargeCharacteristics
Simulated Test at 21ºC (70ºF)



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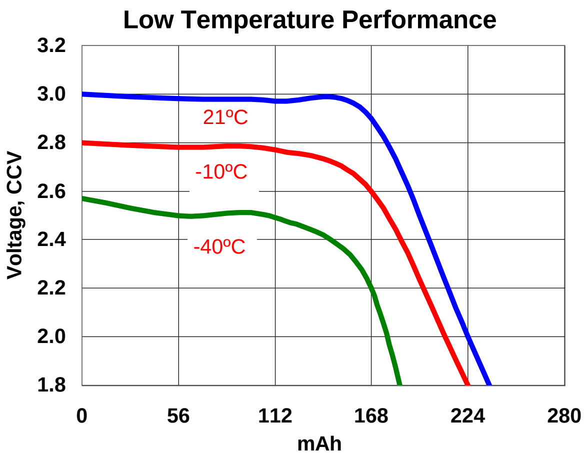
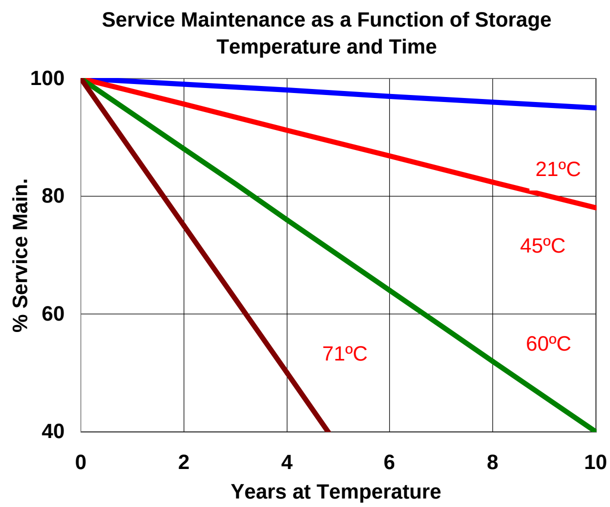
Form No. EBC - 4120C





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Home | Primary | Recharg. | Glossary | Comments | Site Map

Back to Lithium Miniature Table

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533 Maryville University Drive
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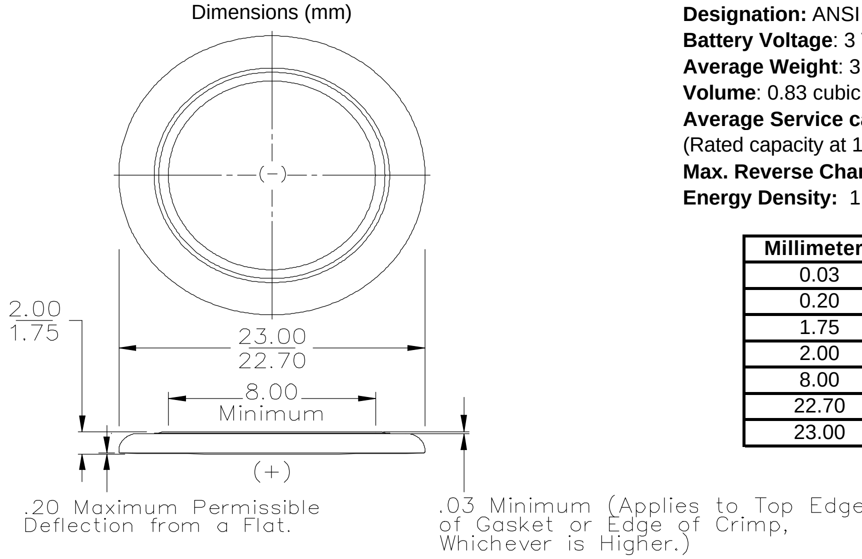
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CR2320

Dimensions (mm)



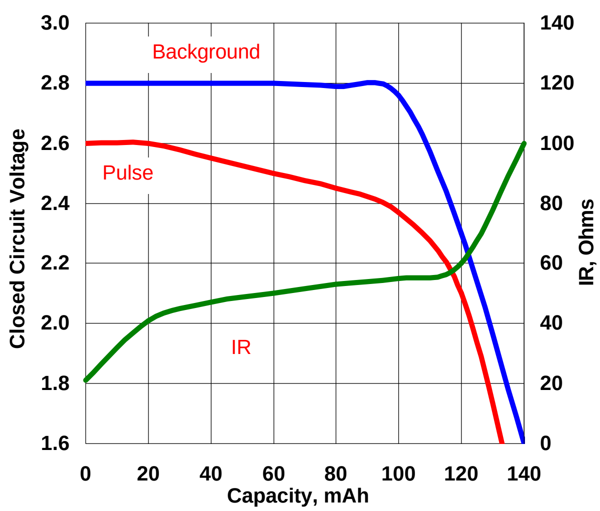
Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

Designation: ANSI / NEDA-5020LC, IEC-CR2320
Battery Voltage: 3 Volts
Average Weight: 3.3 grams (0.10 oz.)
Volume: 0.83 cubic centimeters (0.05 cubic inch)
Average Service capacity (to 2.0 Volts): 135 mAh
(Rated capacity at 10K ohms at 21ºC)
Max. Reverse Charging Current: 1 microampere
Energy Density: 119 milliwatt hr/g, 472 milliwatt hr/cc

Millimeters	Inches
0.03	0.001
0.20	0.008
1.75	0.069
2.00	0.079
8.00	0.315
22.70	0.894
23.00	0.906

INTERNAL RESISTANCE CHARACTERISTICS
Pulse Test at 21ºC (70ºF)

Schedule: Continuous for background
2 seconds X 12 times/day for pulse
Typical Background Drain @ 2.9V (milliamps):
0.29 milliamperes
Typical Pulse Drain @ 2.6V (milliamps):
8.60 milliamperes
Background Load:
10k ohms
Pulse Load:
300 ohms

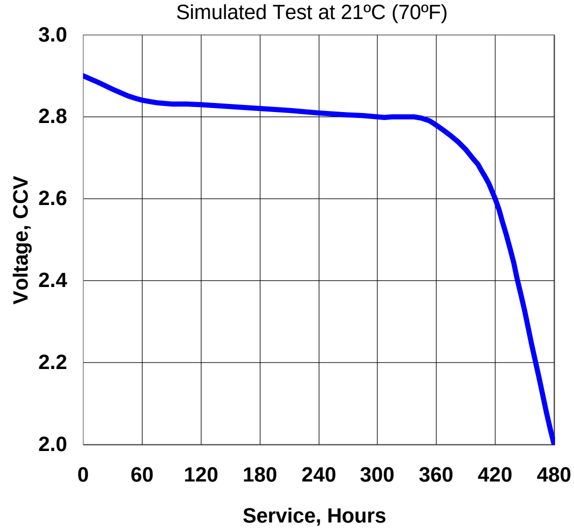


SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.9V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V
			hours
24 hours / day	**290**	**10,000**	**476**

Typical DischargeCharacteristics

Simulated Test at 21ºC (70ºF)



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Home | Primary | Recharg. | Glossary | Comments | Site Map

Back to Lithium Miniature Table

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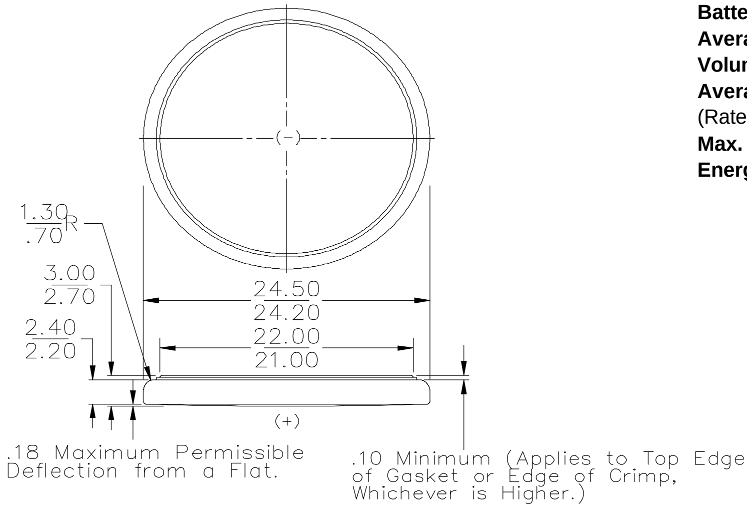
Eveready Battery Company, Inc.

533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CR2430

Dimensions (mm)



Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

Designation: ANSI / NEDA-5011LC, IEC-CR2430
Battery Voltage: 3 Volts
Average Weight: 4.6 grams (0.16 oz.)
Volume: 1.3 cubic centimeters (0.08 cubic inch)
Average Service capacity (to 2.0 Volts): 290 mAh
(Rated capacity at 10K ohms at 21ºC)
Max. Reverse Charging Current: 1 microampere
Energy Density: 183 milliwatt hr/g, 647 milliwatt hr/cc

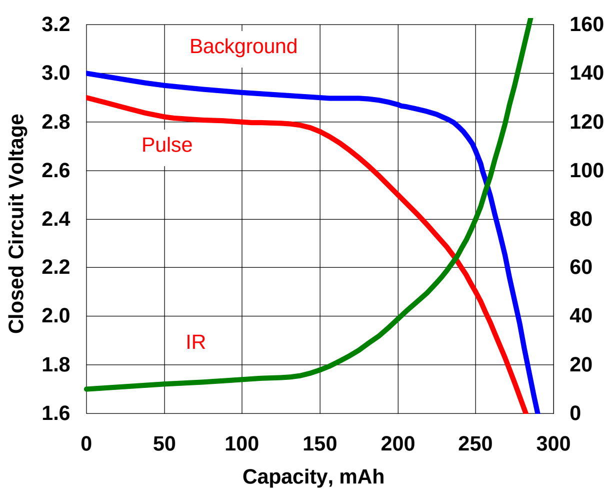
Millimeters	Inches
0.10	0.004
0.18	0.007
0.70	0.028
1.30	0.051
2.20	0.087
2.40	0.094
2.70	0.106
3.00	0.118
21.00	0.827
22.00	0.866
24.20	0.953
24.50	0.965

INTERNAL RESISTANCE CHARACTERISTICS
Pulse Test at 21ºC (70ºF)

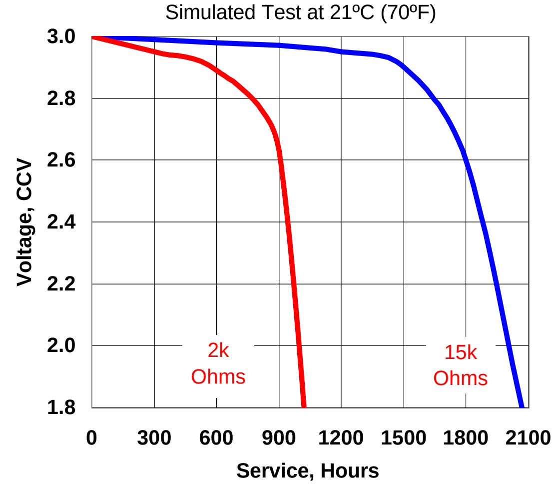
Schedule: Continuous for background
2 seconds X 12 times/day for pulse
Typical Background Drain @ 2.9V (milliamps):
0.29 milliamperes
Typical Pulse Drain @ 2.6V (milliamps):
9.30 milliamperes
Background Load:
10k ohms
Pulse Load:
300 ohms

SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.9V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V
			hours
24 hours / day	**145**	**20,000**	**2,000**
24 hours / day	**290**	**10,000**	**1,000**



Typical DischargeCharacteristics
Simulated Test at 21ºC (70ºF)



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Home | Primary | Recharg. | Glossary | Comments | Site Map

Back to Lithium Miniature Table

Energizer

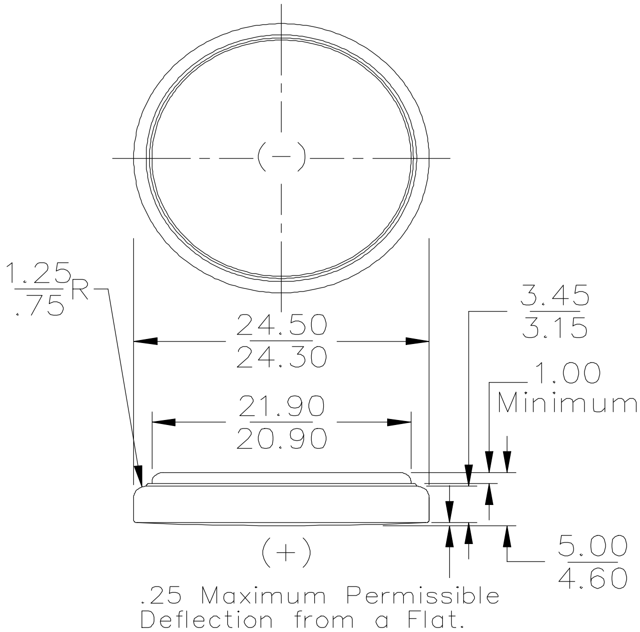
Eveready Battery Company, Inc.

533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

ENERGIZER NO. CR2450

Dimensions (mm)



Chemical System: Lithium/Manganese Dioxide (Li/MnO_2)

Designation: Not yet Available
Battery Voltage: 3 Volts
Average Weight: 6.9 grams (0.24 oz.)
Volume: 2.4 cubic centimeters (0.14 cubic inch)
Average Service capacity (to 2.0 Volts): 575 mAh
(Rated capacity at 5.1K ohms at 23ºC)
Energy Density: 242 milliwatt hr/g, 695 milliwatt hr/cc

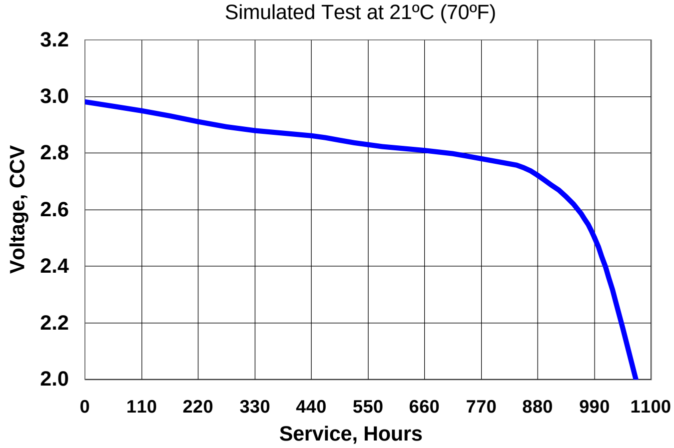
Millimeters	Inches
0.25	0.010
0.75	0.030
1.00	0.039
1.25	0.049
3.15	0.124
3.45	0.136
4.60	0.181
5.00	0.197
20.90	0.823
21.90	0.862
24.30	0.957
24.5	0.965

SIMULATED APPLICATION TESTS
Estimated Average Service at 21ºC (70ºF)

Schedule	Typical Drains @ 2.9V (microamperes)	Load (ohms)	CUTOFF VOLTAGE 2.0V
			hours
24 hours / day	**568**	**5,100**	**1,060**

Typical DischargeCharacteristics

Simulated Test at 21ºC (70ºF)



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Energizer

Home | Primary | Recharg. | Glossary | Comments | Site Map

Back to Lithium Miniature Table

Back to Index Printer Friendly Version

Energizer Alkaline Application Manual

Table of Contents

Energizer Cylindrical Alkaline (Zn/MnO_2) Batteries

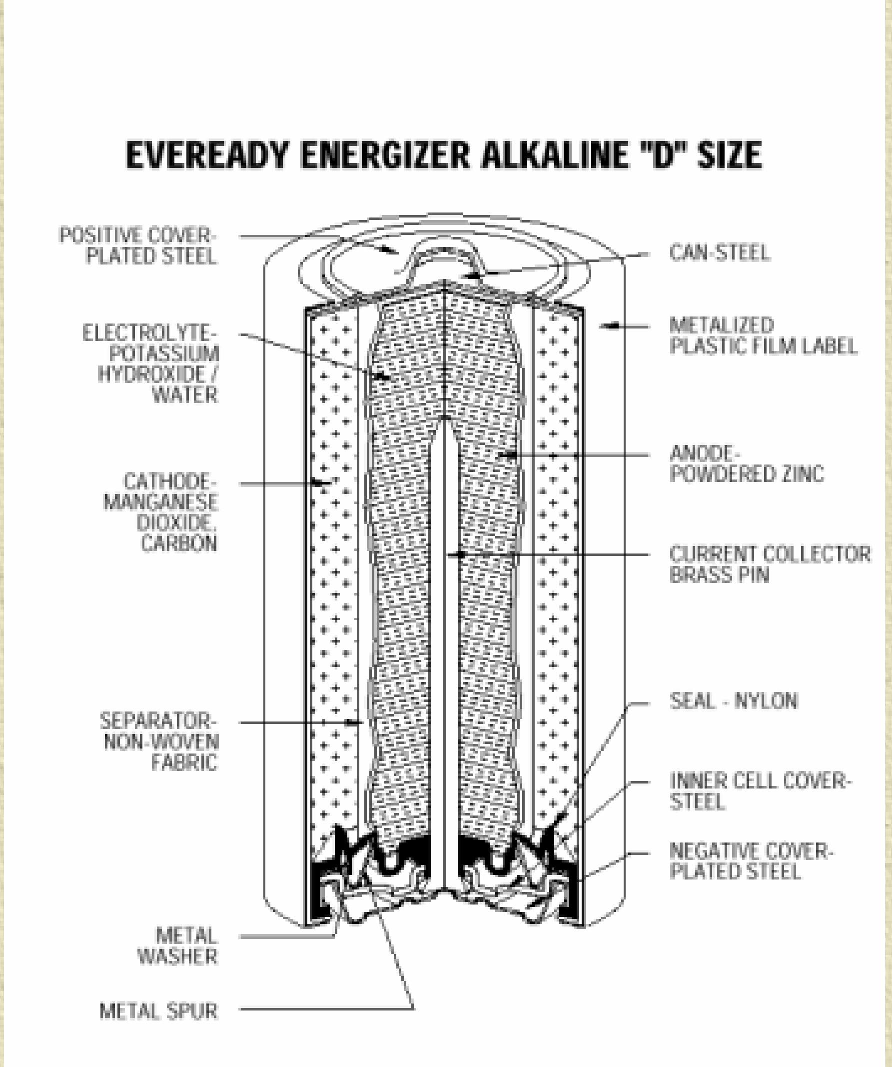
System Description

In answer to a growing need for a high rate source of portable power, Energizer technology has developed the Energizer Alkaline, Advanced Formula battery. The Energizer Alkaline system is designed to provide an economical power source for today's devices that require heavy current or continuous use. The general characteristics of the Alkaline system are:

- Better discharge rate capability than Carbon Zinc
- Lower and more stable internal resistance than Carbon Zinc
- Better low temperature performance than Carbon Zinc
- Better service maintenance than Carbon Zinc
- Higher energy density than Carbon Zinc
- More economical than Carbon Zinc in terms of cost per hour of use on high current drains
- Sloping discharge curve
- Relatively insensitive to changes in the discharge rate or duty cycle
- Available in voltages ranging from 1.5 to 12.0 and in a variety of shapes and sizes

Battery Description

Cylindrical Alkaline batteries are produced with a high surface area zinc anode, a high density manganese dioxide cathode, and a potassium hydroxide electrolyte. A cutaway of a typical cylindrical Alkaline battery is illustrated in the following diagram:



Click here for Adobe Cross Section (.pdf file)

Cathodes are a mixture of high purity electrolytic manganese dioxide and carbon conductor.
Anodes are a gelled mixture of zinc powder and electrolyte
Separators of specially selected materials prevent migration of any solid particles in the battery
Steel can confines active materials and serves as the cathode collector
Brass pin serves as the anode collector
Top and bottom covers provide contact surfaces of nickel-plated steel
Non-conductive plastic film label electronically insulates the battery
Molded nylon seal provides a safety venting mechanism

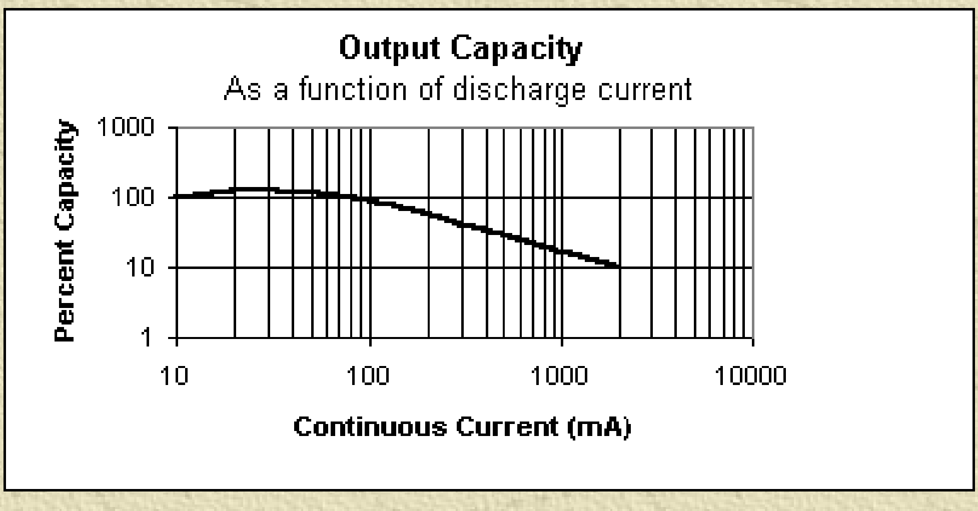
Electrochemistry

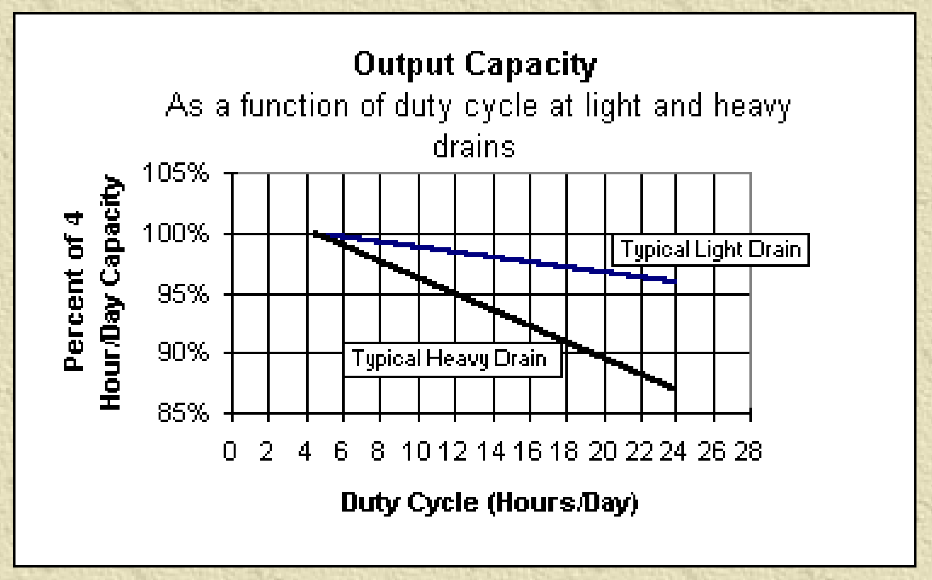
The rate capability, energy density, service maintenance and low temperature performance of the cylindrical Alkaline system are the result of an electrochemical interaction between:

- A high purity, high density cathode containing a conductive carbon matrix.
- A high purity, high surface area zinc anode.

- A highly conductive, low freezing point electrolyte solution.

The open circuit voltage of fresh cylindrical Alkaline batteries is typically 1.58 volts. The closed circuit voltage declines gradually as a function of the depth of discharge; therefore greater hours of service are obtained as the functional end point voltage is lowered. The energy output of Alkaline batteries is less sensitive to variation in the discharge rate and duty cycle than comparable size LeClanche or Zinc Chloride batteries. Typical D size Alkaline performance to a 0.9 volt cutoff is shown in the following diagrams:



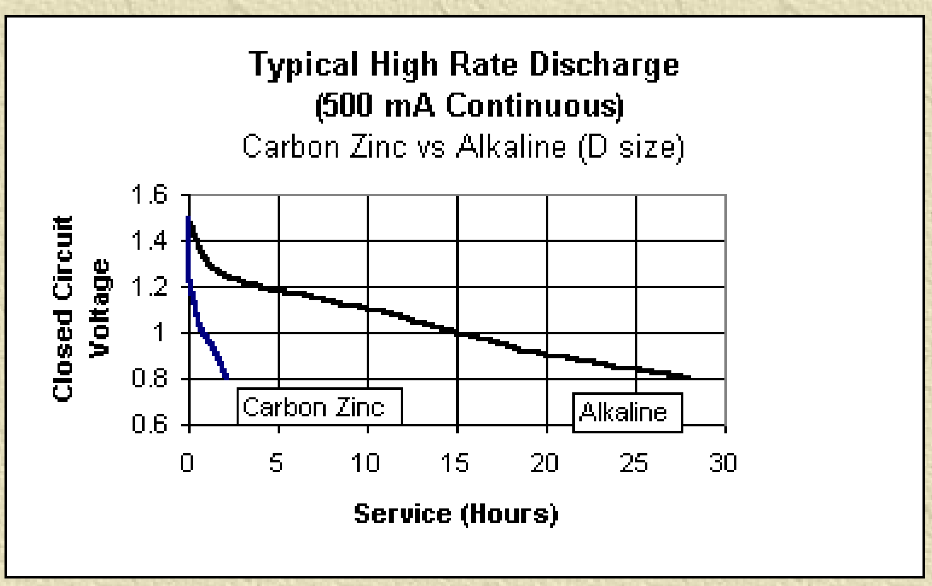


The electrochemical inputs of cylindrical Alkaline batteries are greater than that of similar sized Carbon Zinc batteries. This additional energy, in conjunction with high efficiency, gives cylindrical Alkaline batteries a service advantage on simulated application tests of 4 to 9 times that of Carbon Zinc as shown in the following chart:

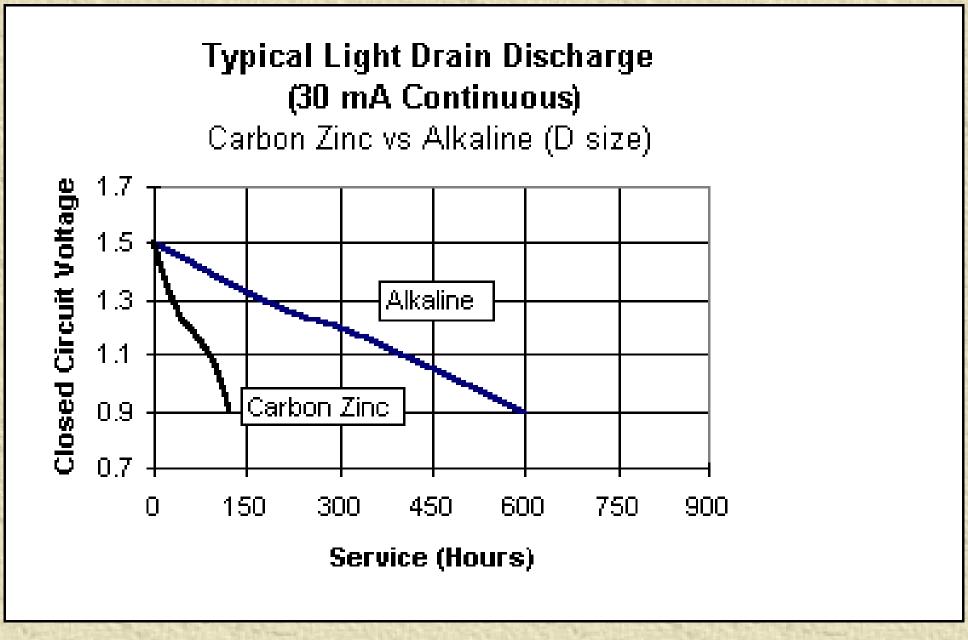
TEST	LOAD	DUTY CYCLE	E95 vs. 950 Typical Percent of Carbon Zinc Service
Motor Toy	**2.2 ohms**	**1 hr/day**	**960%**

Recorder	**3.9 ohms**	**1 hr/day**	**440%**
Flashlight	**2.2 ohms**	**4 min/hr, 8 hrs/day**	**400%**
Radio	**39 ohms**	**4 hrs/day**	**425%**

This ability of cylindrical Alkaline batteries to deliver more energy than Carbon Zinc under continuous or heavy duty, high drain conditions is shown by the following discharge curves:



However, as the drain rate is decreased and the duty cycle on-time reduced, the service difference between the Alkaline and Carbon Zinc systems is reduced. This reduction in the service difference is shown by the following discharge curves:



Temperature

In general, changes in usage temperature affect the service of Alkaline batteries to a lesser degree than comparable size Carbon Zinc batteries.

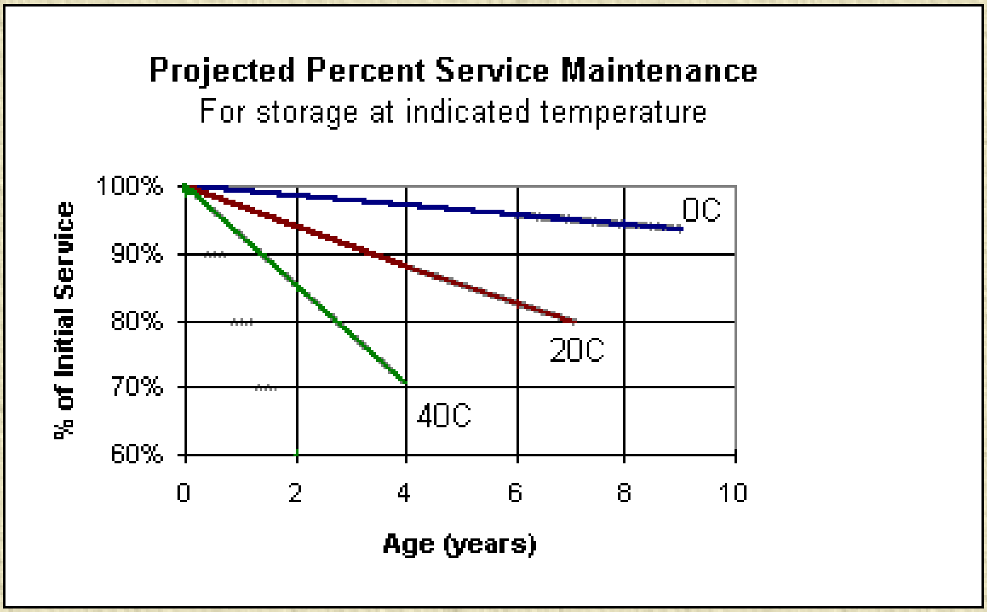
Heavy drain is defined as current that would discharge the battery within one day at room temperature.

Moderate drain is defined as a current that would discharge the battery in approximately one week at room temperature.

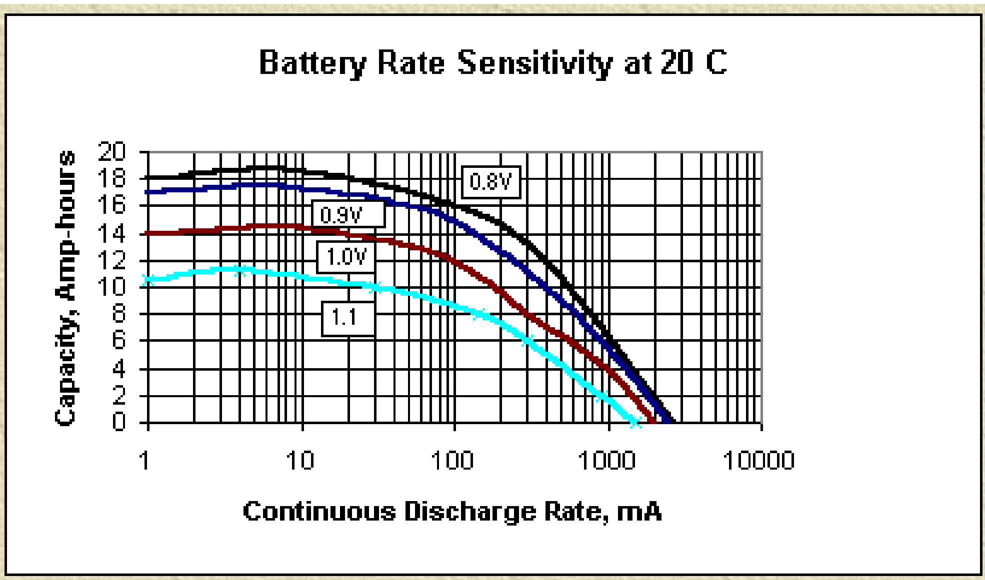
Light drain is defined as a current that would discharge the battery after one month or more at room temperature.

Service on all drains after storage at high temperatures is eventually reduced by an increase in self discharge.

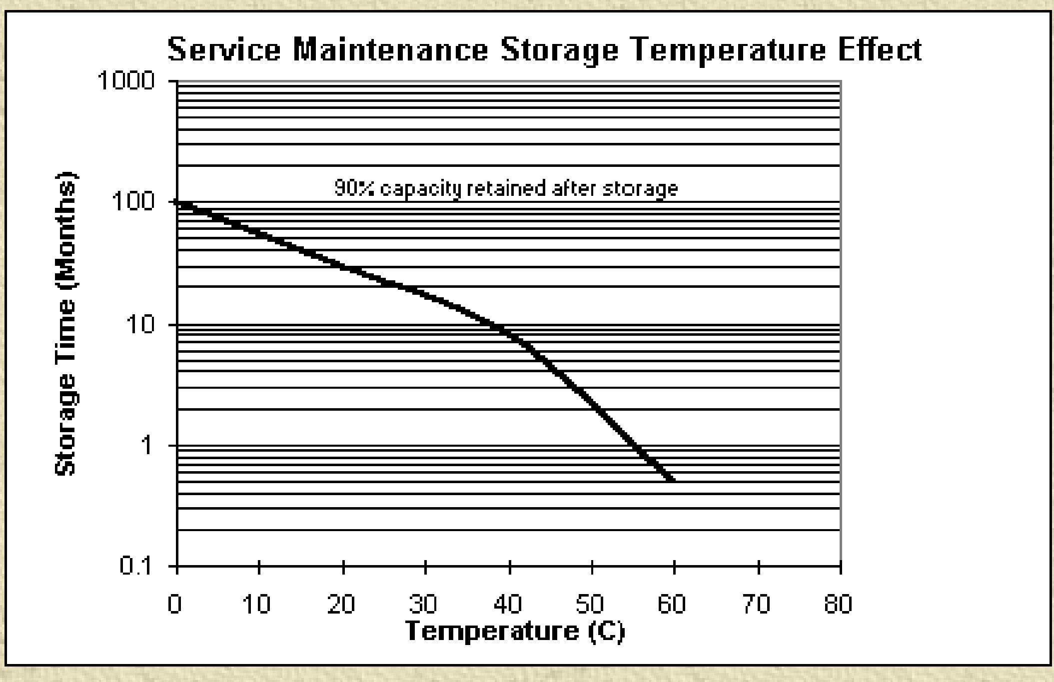
Because of the high purity of materials used, their basic electrochemical stability, and patented sealing techniques, Energizer Alkaline batteries exhibit excellent service maintenance characteristics. On moderate drains between a 0.75 volt and 0.9 volt Functional End Point (FEP), the following typical service maintenance can be expected at storage periods and temperatures indicated below.



The testing of cylindrical Alkaline batteries at higher or lower discharge rates can affect the percent of retained ampere-hour capacity by approximately 5% to 10%.

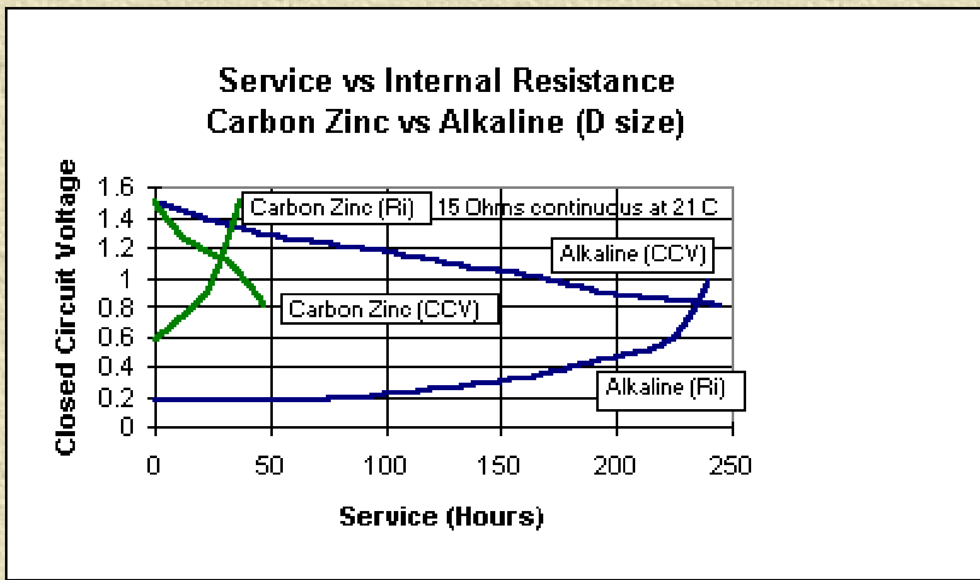


While the storage of Alkaline batteries at temperatures below 21ºC will increase their service maintenance, the percentage of ampere-hour capacity saved makes storage at low temperatures uneconomical under most circumstances. Storage at temperatures exceeding 21ºC for sustained periods of time will significantly reduce service maintenance. However, in all cases, the high temperature service maintenance of Alkaline batteries is greater than comparable Carbon Zinc. The typical effect of storage temperature on Alkaline service maintenance is shown in the following diagram.



Internal Resistance

The internal resistance (R_i) of a battery is its opposition to the flow of current. In all cases, this resistance increases as the temperature of a battery decreases. While the absolute R_i will vary with the load, the rate at which it increases in cylindrical Alkaline batteries is significantly less than that of Carbon Zinc. The R_i of a cylindrical Alkaline battery remains relatively constant until it approaches end of service life and then increases rapidly as shown in the following diagram:



Internal resistance is typically measured in one of two ways:

1. As a reduction in closed circuit voltage when the applied load is increased (voltage drop)

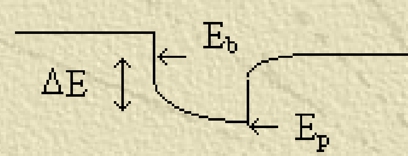
2. As a maximum short circuit current (flash amps)

The R_j values obtained are subject to a number of variables and measurement techniques. The effective R_j values shown on individual data pages were calculated using the voltage drop method which projects the batteries current carrying capability in actual device applications. This calculation involves placing a battery on a constant background load, allowing it to stabilize, and then pulsing it with a heavier load for one second. The resulting voltage drop is then measured and expressed in terms of ohms as shown in the following example:

Determination of Internal Resistance

Voltage Drop Method

R_j = Internal Resistance
R_b Resistance of Background Load
E_b = Background Voltage
R_p = Resistance at Pulse Load
E_p = Voltage at End of Pulse
ΔE = Voltage Change
ΔI = Current Change
I_b = Background Current
I_p = Current at End of Pulse



$$I_b = \frac{E_b}{R_b}$$

$$I_p = \frac{E_p}{R_p}$$

$$R_j = \frac{\Delta E}{\Delta I} = \frac{E_b - E_p}{I_p - I_b}$$

Although short circuit current (flash amps) does not indicate battery freshness or potential service, circuit designers should be aware of the maximum current that a battery could supply if a component failure occurs. Given below are typical maximum flash amperage values for Energizer Alkaline batteries. These flash amp values can vary widely without affecting battery service in actual applications and will typically be 50 to 60% of maximum shown.

Alkaline Battery Size	Typical Maximum Flash Amperage(total circuit resistance of 10 milliohms or less)
D	16
C	15
AA	10
AAA	9
AAAA	8
N	7
6V	20
9V	9

The exceptional current carrying capability, low and essentially constant internal resistance, shelf life and good low temperature performance of Eveready Energizer Alkaline batteries enables them to meet a wide variety of device application requirements, such as:

Heavy Duty Lighting
Camera Motor Drives
Cassette Players and Recorders
Shavers
Portable Radios
Portable TV’s
Motor Toys
Clocks
Remote Controlled Models
Transceivers
Electronic Games
Cellular Telephones
Electronic Photoflashes
Security Devices (Alarms, Smoke Detectors)
Compact Disc Players
Pagers
Portable Computers
Electronic Organizers
Video Cameras

Battery Testing

Measuring the open circuit voltage (OCV) of a battery to determine the amount of service life will yield a rough estimate. A more accurate method is to measure the closed circuit voltage (CCV) of the battery. This is accomplished by putting the battery under load for one to two seconds and measuring the CCV. If the battery voltage is greater than or equal to 1.1 volts, the battery has approximately 20% service left. The load is determined by the size and type of battery. In the case of a single cylindrical 1.5 volt Alkaline or Carbon Zinc battery, the load would be approximately 8 ohms.

Otherwise, an OCV reading of 1.5 volts or greater for a single cylindrical 1.5 volt Alkaline or Carbon Zinc battery indicates essentially an undischarged battery or one that has been discharged less than 10%.

Key Factors in Battery Selection

Selecting a battery can be as simple as buying one for a penlight or as complicated as specifying a source of stored energy for a satellite transmitter. Although the many types of batteries and battery systems may seem to make a proper choice difficult, the problem can be somewhat simplified by first outlining the application requirements and then selecting a battery to meet them.

Application Information

Before a battery or battery system can be specified, the minimum information that must be determined for the application is:

- Voltage
- Current Drains
- Operating Schedule
- Required Service Life
- Service Temperatures
- Size and Weight
- Environment
- Type of Terminals

If the equipment will not operate below a certain critical voltage, this endpoint voltage should be specified. Both initial and operating current drains may need to be specified. This, along with the discharge schedule and required service life, will determine the capacity for the battery. Service temperatures must be known because they will affect battery capacity, life or both. If the battery will be stored for any period of time before use, the length of time and the temperature should also be indicated. Allowable size and weight will sometimes determine which battery is selected in spite of other requirements.

Shock or vibration criteria may indicate the need for a rugged battery construction. Unusual rates of acceleration or high-altitude operation are also a part of the environmental considerations. Storage time and temperature under any of these conditions should be noted.

Secondary (rechargeable) system should be considered if the battery-operated devices cannot be economically powered by primary batteries.

The discussion of the basic characteristics and features of various battery systems, which can be found in the "Typical Characteristics" table located under the "Battery Information" section of the website, will indicate which system (or systems) is most suitable for the application. Ideal characteristics may not be found in any one battery design nor can the characteristics of one battery always be compared directly with those features of others. Therefore, optimum performance of a battery in an application can usually be best achieved by first meeting the critical needs of the application and subordinating the others.

Warnings

Charging of Primary Batteries
Charging of primary batteries may cause explosion or leakage which may result in bodily injury. IF ENERGIZER/EVEREADY PRIMARY BATTERIES ARE SUBJECTED TO ANY FORM OF RECHARGING, ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE NULL AND VOID.
Metal-Jacketed Batteries
It is important to note that some batteries have metal jackets. Proper design of devices using these batteries should include electrical isolation of the battery jacket from the device circuitry to prevent short circuiting. Short circuits may cause battery explosions or leakage which may result in bodily injury.
Plastic Film Labels
It is important to note that some batteries have plastic film labels over the metal raw cell. Proper design of devices using these batteries should include electrical insulation as well as the avoidance of burrs and/or sharp edges and corners that can cut through the plastic and result in battery shorting or inadvertent charging.
Other
There are many other conditions to avoid for the proper safe use of batteries. It is imperative to read the section "Design and Safety Considerations" to assure that other safety considerations are not overlooked.

Back to Top of Page

Back to Alkaline Consumer / OEM Table

521

Eveready Battery Company, Inc.

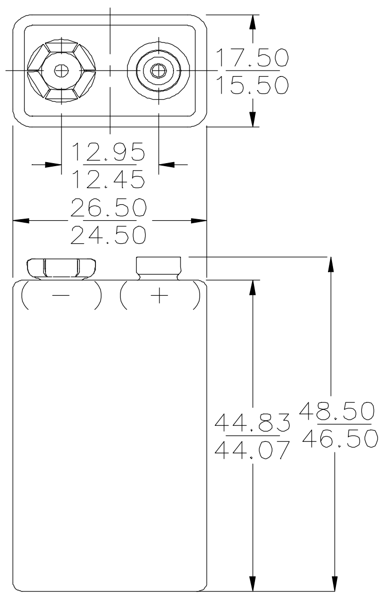
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Alkaline **9V**
No Added Mercury or Cadmium

ENERGIZER NO. 522

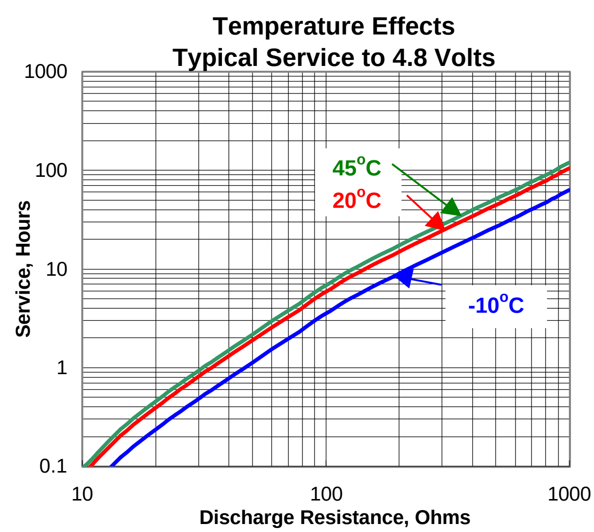
Dimensions (mm)

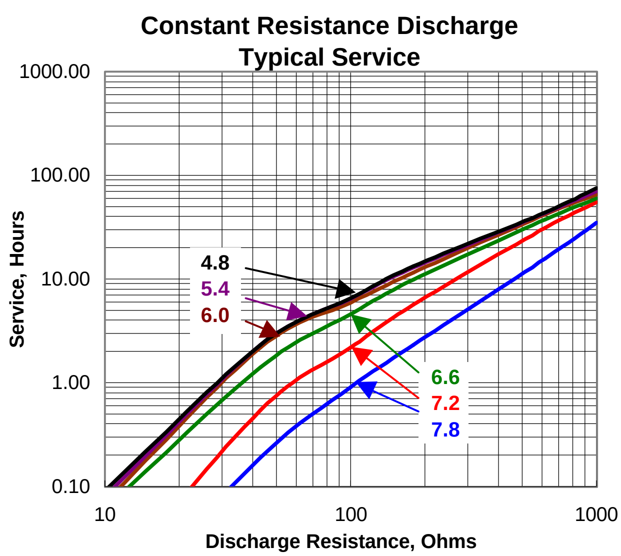


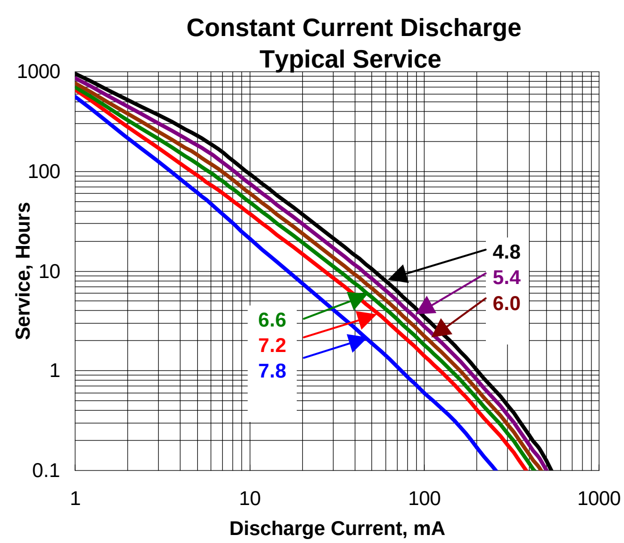
Millimeters	Inches
12.45	0.490
12.95	0.510
15.50	0.610
17.50	0.689
24.50	0.965
26.50	1.043
44.07	1.735
44.83	1.765
46.50	1.831
48.50	1.909

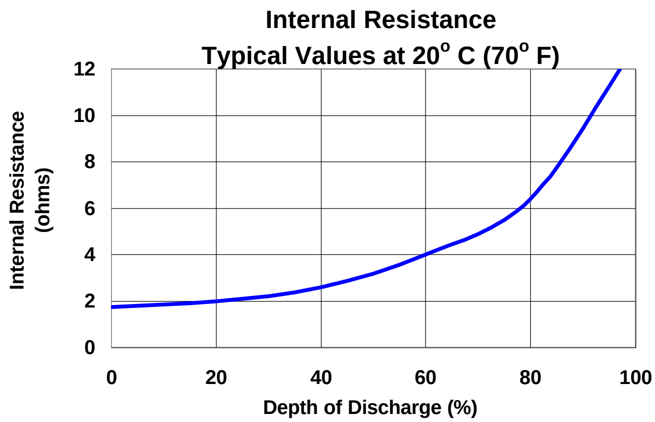
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-1604A, IEC-6LR61
Battery Voltage: 9 Volts
Average Weight: 45.6 grams (1.60 oz.)
Volume: 21.1 cubic centimeters (1.3 cubic inch)
Average Service capacity (to 0.8 Volts / cell): 595 mAh
(Rated Capacity at 25mA continuous drain)
Cell: Six No. 3-0316 in series
Jacket: Metal
Shelf Life: 5 years

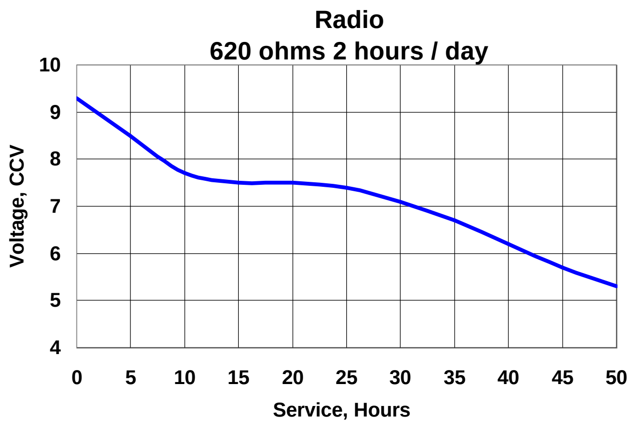


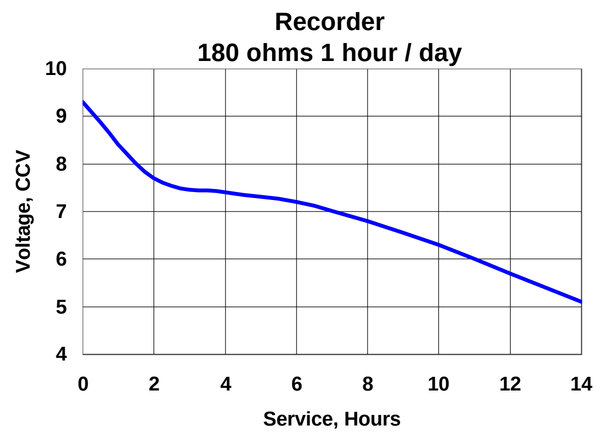


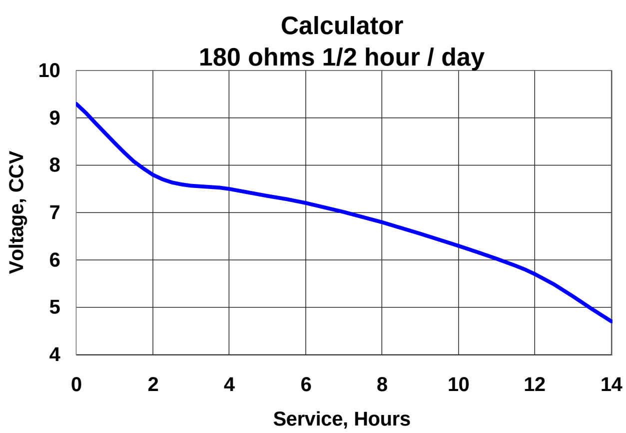


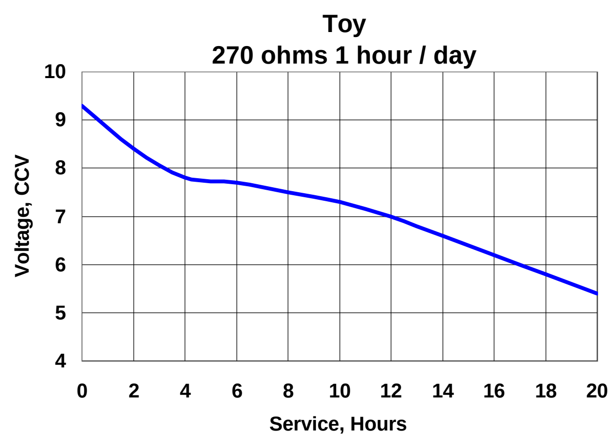


Typical Applications









Important Notice

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Back to Alkaline Consumer / OEM Table

522

Eveready Battery Company, Inc.

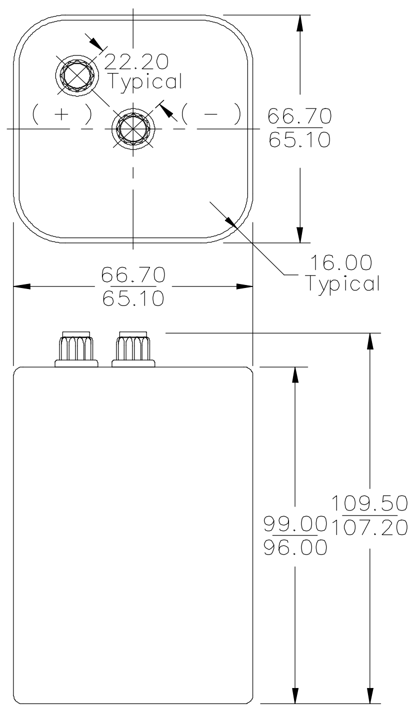
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Alkaline **6V**
No Added Mercury or Cadmium

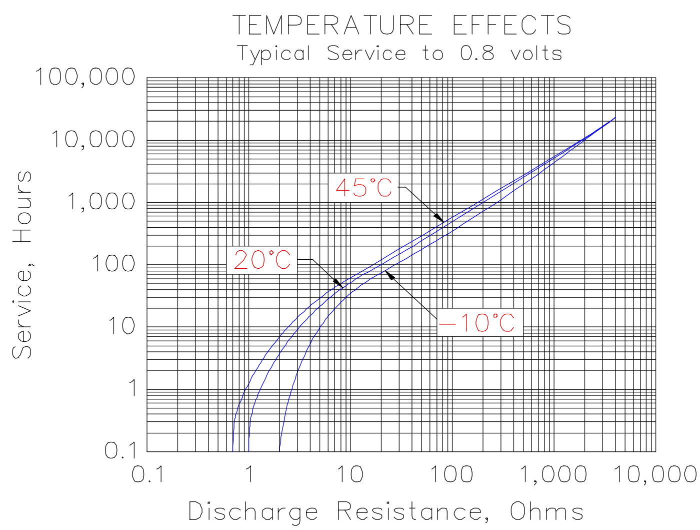
ENERGIZER NO. 528

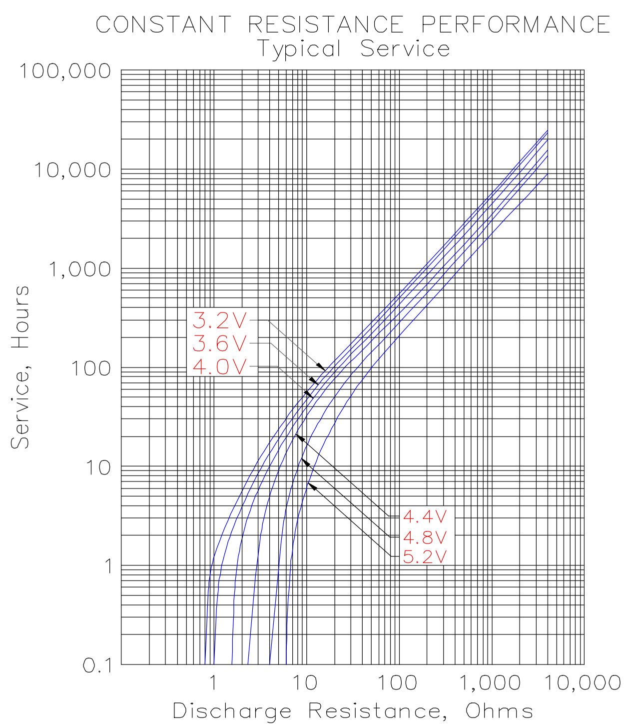
Dimensions (mm)

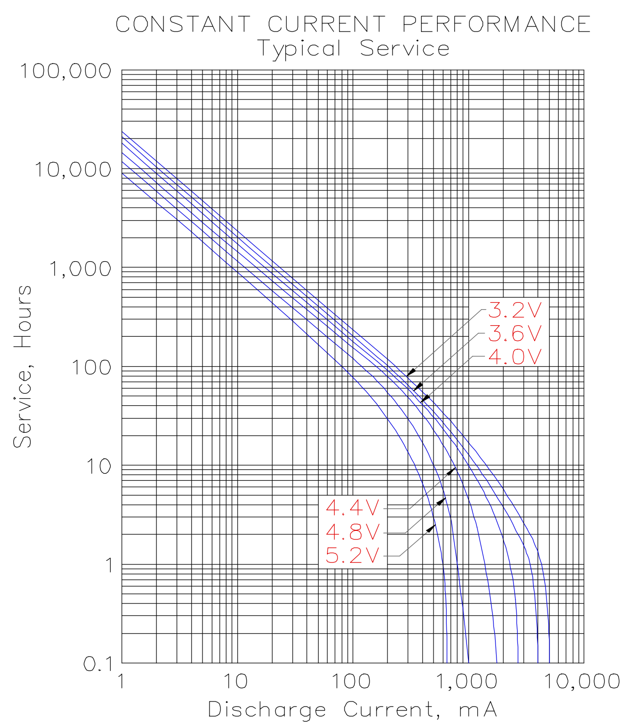


Millimeters	Inches
16.00	0.630
22.20	0.874
65.10	2.563
66.70	2.626
96.00	3.780
99.00	3.898
107.20	4.220
109.50	4.311

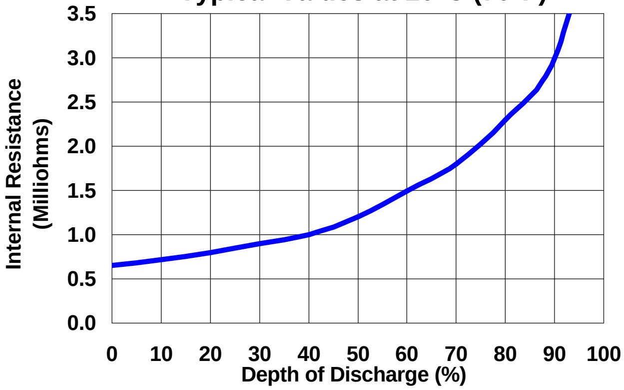
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-915A, IEC-4R25Y
Battery Voltage: 6 Volts
Terminal: Plastic Knurl / Screw Post
Average Weight: 885 grams (31.3oz.)
Volume: 434 cubic centimeters (26.5 cubic inch)
Average Service capacity (to 0.8Volts / cell): 26 Ah
(Rated Capacity at 25 mA continuous drain)
Cell: Four No. 3-361 in series
Jacket: Metal





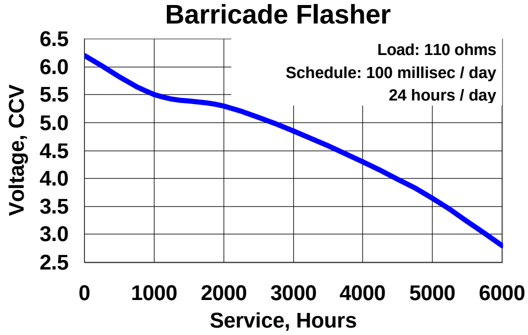


Internal Resistance
Typical Values at 20°C (70°F)

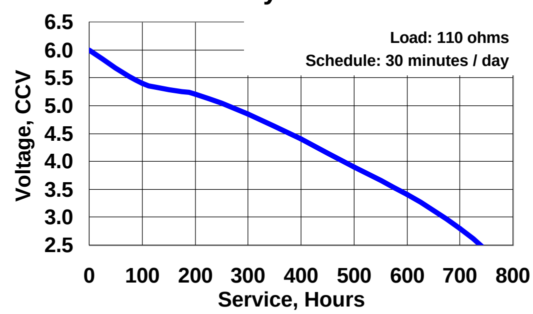


Typical Applications

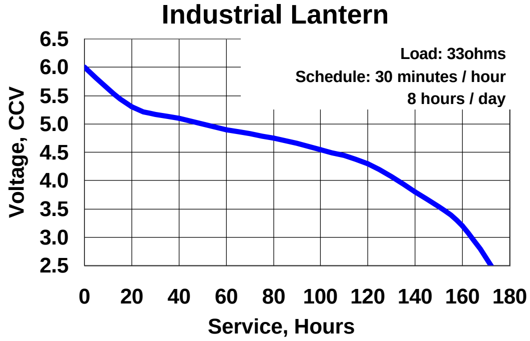
Barricade Flasher



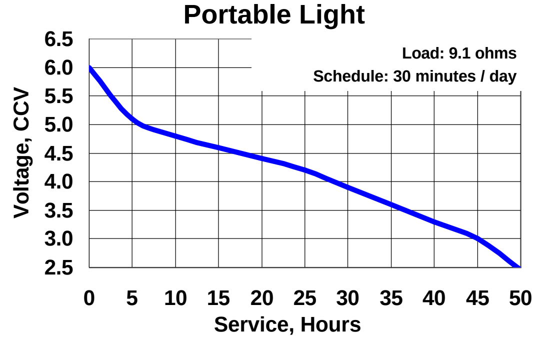
Steady Burn



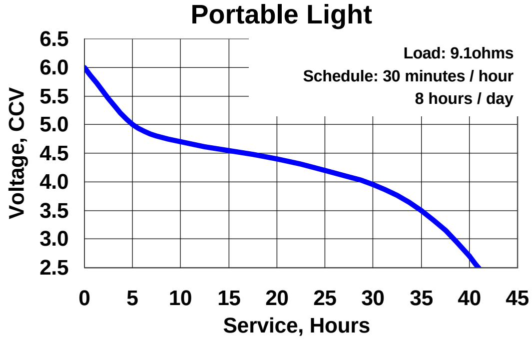
Industrial Lantern



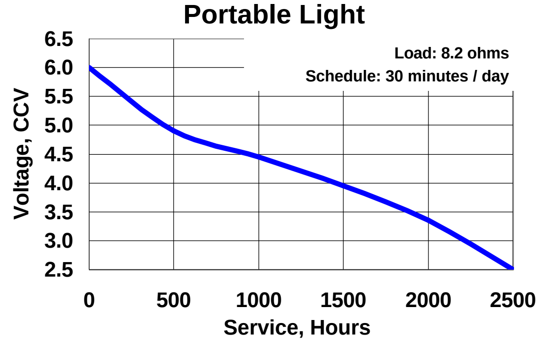
Portable Light



Portable Light



Portable Light



Important Notice

Back to Alkaline Consumer / OEM Table

528

Eveready Battery Company, Inc.

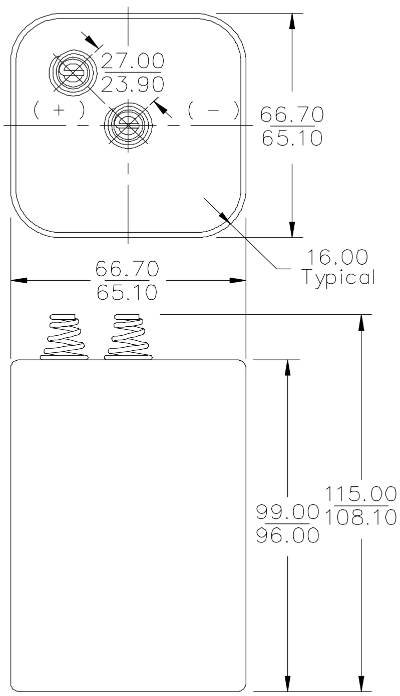
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

Alkaline **6V**
No Added Mercury or Cadmium

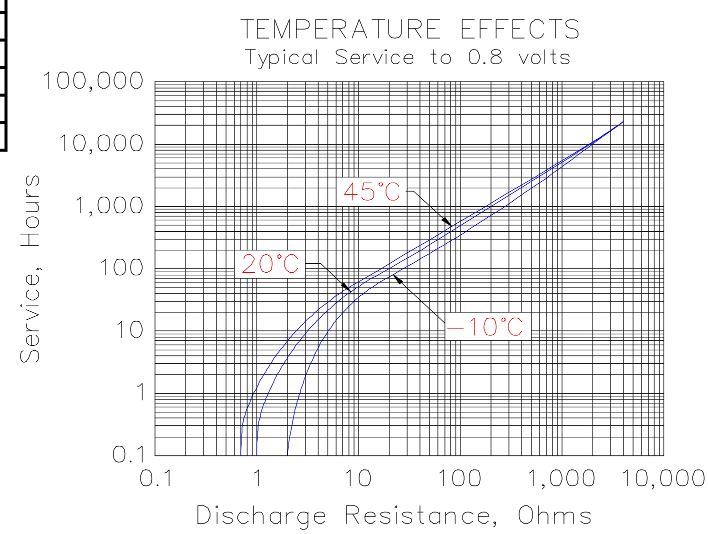
ENERGIZER NO. 529

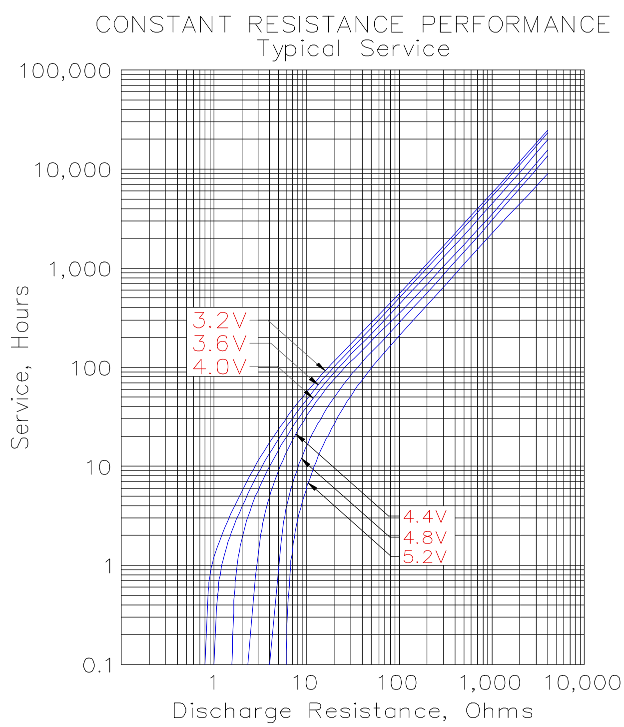
Dimensions (mm)

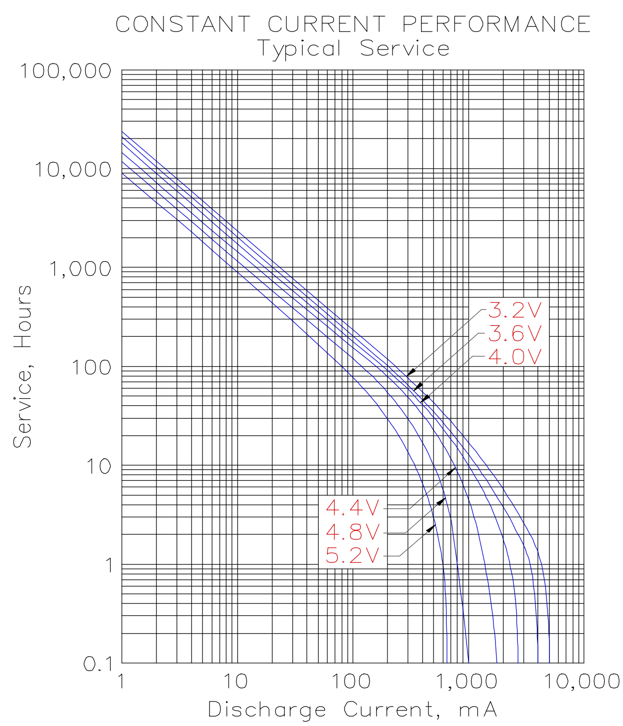


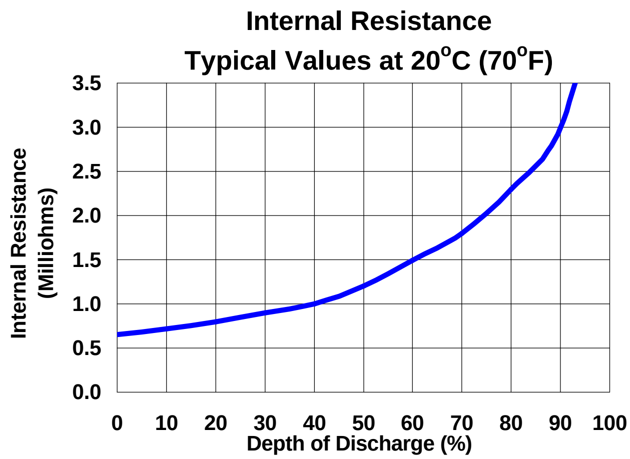
Millimeters	Inches
16.00	0.630
23.90	0.941
27.00	1.063
65.10	2.563
66.70	2.626
82.60	3.252
96.00	3.780
99.00	3.898
101.60	4.000
108.10	4.256
115.00	4.528

Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI / NEDA-908, IEC-4R25X
Battery Voltage: 6 Volts
Terminal: Coil Springs
Average Weight: 885 grams (31.3oz.)
Volume: 440.4 cubic centimeters (26.9cubic inch)
Average Service capacity (to 0.8Volts / cell): 26 Ah
(Rated Capacity at 25 mA continuous drain)
Cell: Four No. 3-361 in series
Jacket: Metal

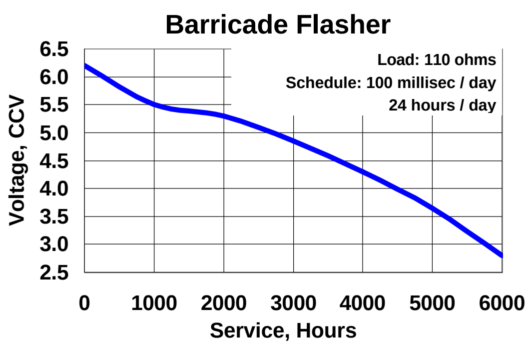


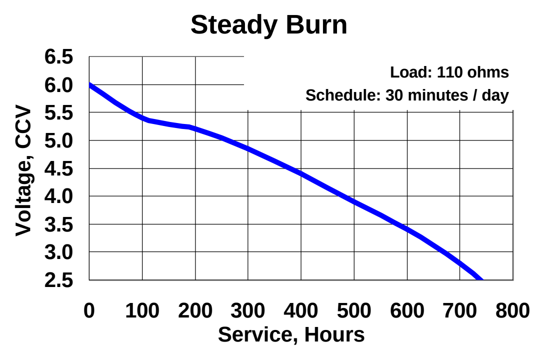


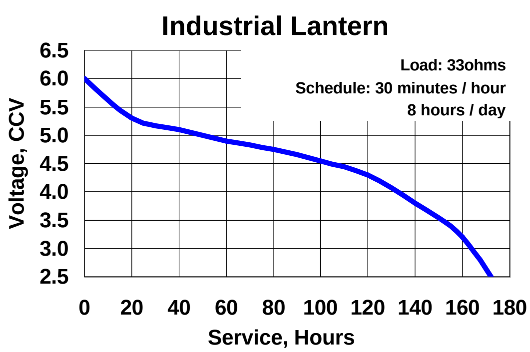


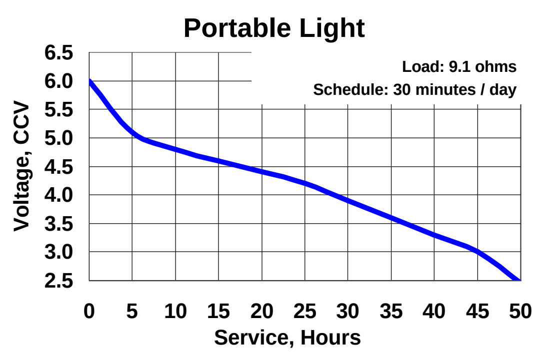


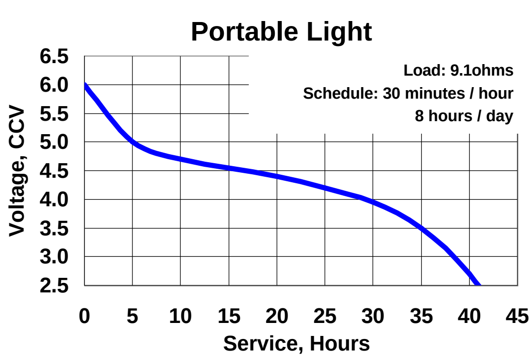
Typical Applications

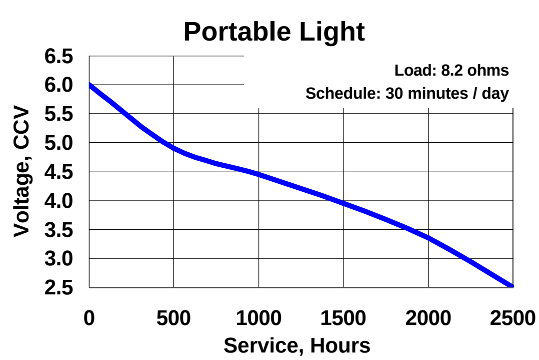












Important Notice

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Back to Alkaline Consumer / OEM Table

529

Eveready Battery Company, Inc.

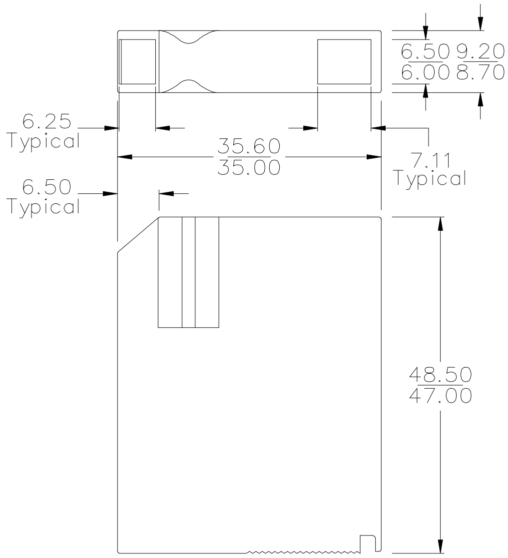
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

J
Alkaline ***6V***
No Added Mercury or Cadmium

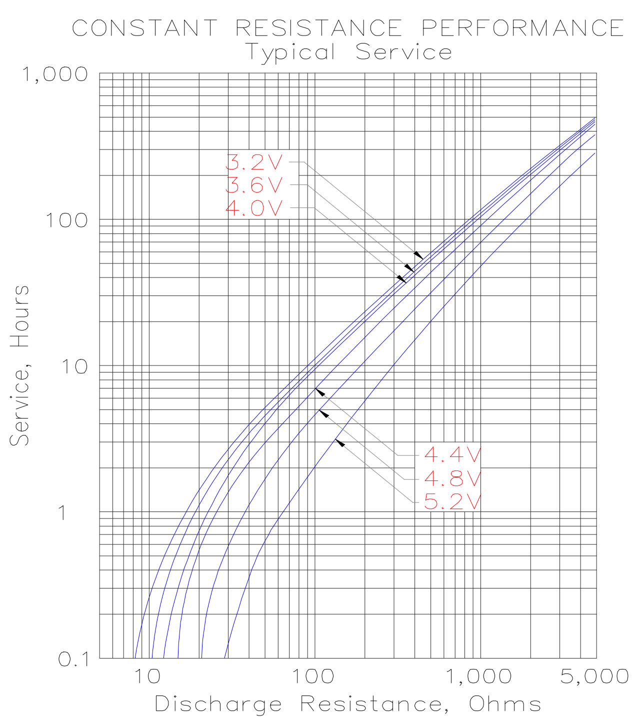
EVEREADY NO. 539

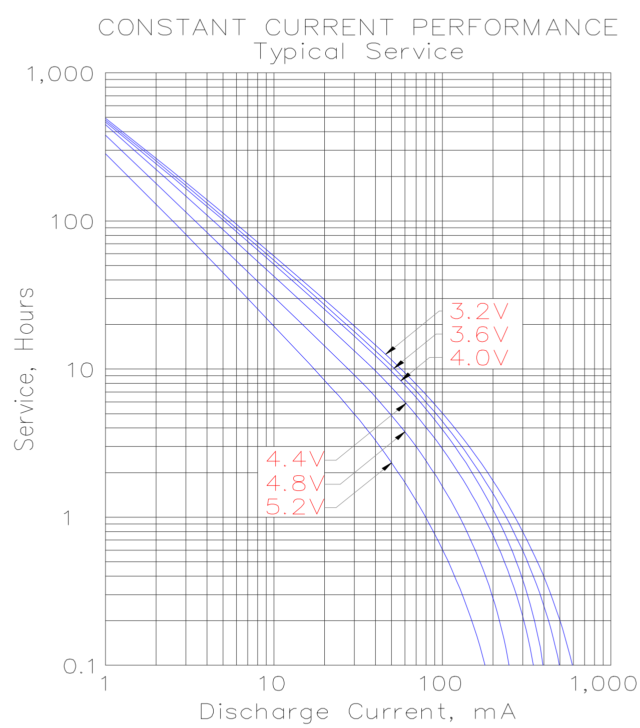
Dimensions (mm)



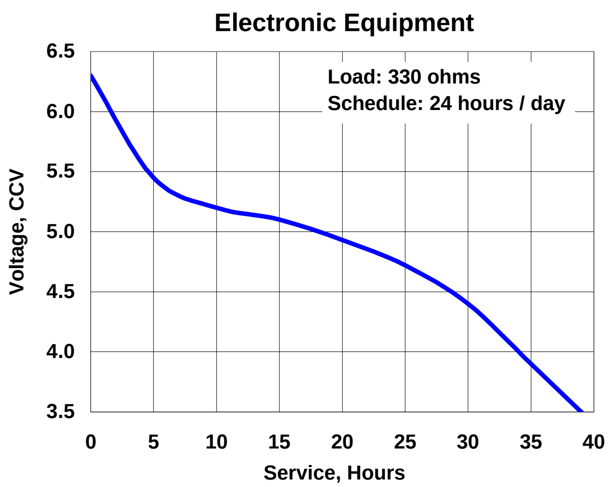
Chemical System:Alkaline-Manganese Dioxide (Zn/MnO_2)
Designation: ANSI-1412AP, IEC-4LR61
Battery Voltage: 6 Volts
Average Weight: 30 grams (1.1oz.)
Volume: 15.4 cubic centimeters (0.9 cubic inch)
Average Service capacity (to 0.8Volts / cell): 595 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: Four No. 3-0316 in series
Jacket: Plastic

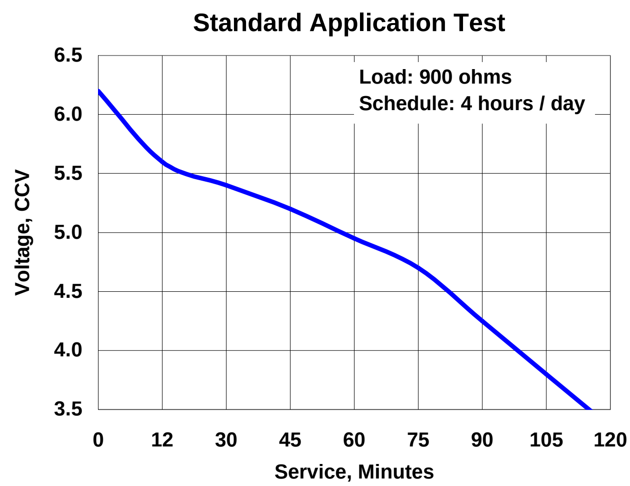
Millimeters	Inches
6.00	0.236
6.25	0.246
6.50	0.256
7.11	0.280
8.70	0.343
9.20	0.362
35.00	1.378
35.60	1.402
47.00	1.850
48.50	1.909

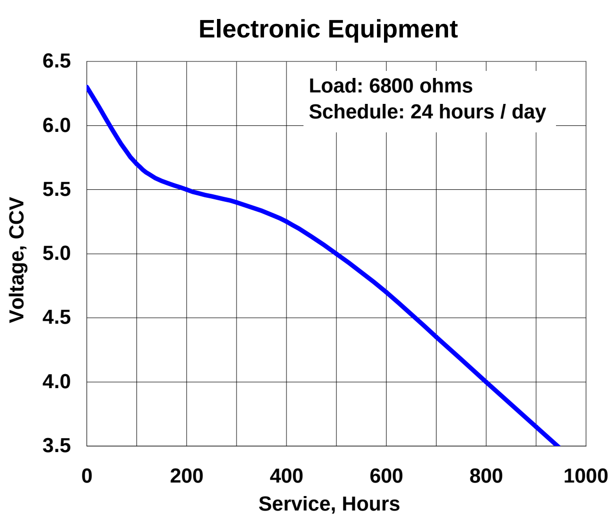


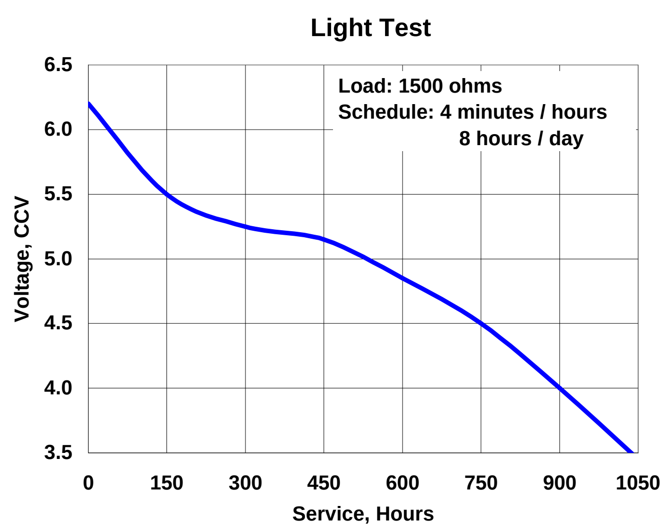


Typical Applications









Important Notice

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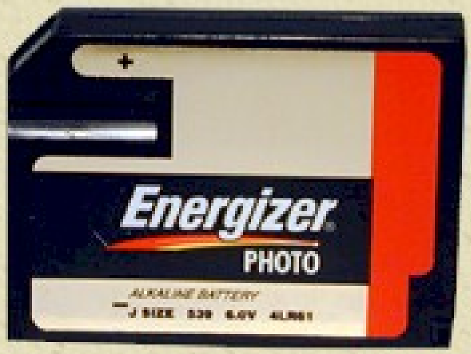
Home | Primary | Recharg. | Glossary | Comments | Site Map

Back to Alkaline Consumer / OEM Table



539

Back to Alkaline Consumer / OEM Table

E90

Home | Primary | Recharg. | Glossary | Comments | Site Map

Back to Alkaline Consumer / OEM Table

E91

Eveready Battery Company, Inc.

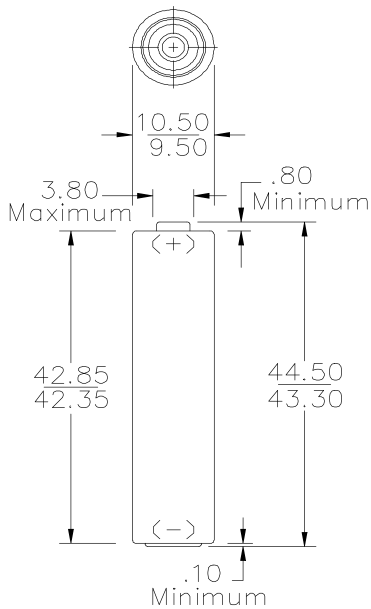
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

AAA
Alkaline **1.5V**
No Added Mercury or Cadmium

ENERGIZER NO. E92

Dimensions (mm)

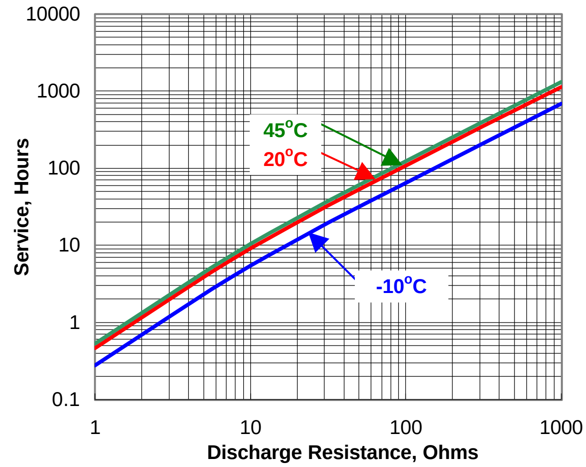


Millimeters	Inches
0.10	0.004
0.80	0.031
3.80	0.15
9.50	0.374
10.50	0.413
42.35	1.667
42.85	1.687
43.30	1.705
44.50	1.752

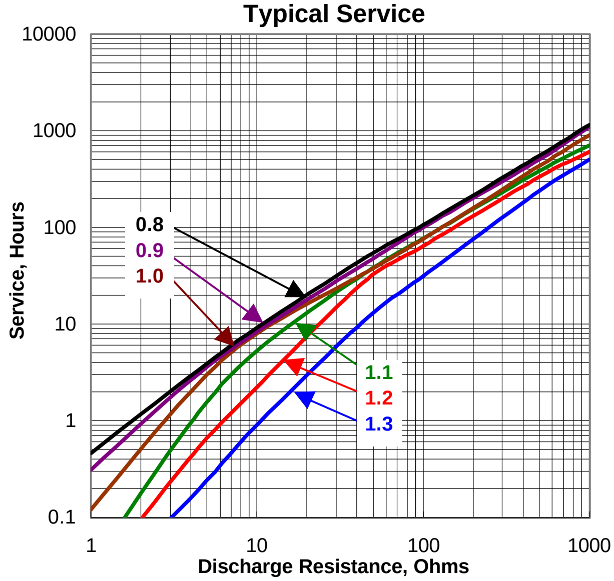
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-24A, IEC-LR03
Battery Voltage: 1.5 Volts
Average Weight: 11.5 grams (0.4 oz.)
Volume: 3.8cubic centimeters (0.2 cubic inch)
Average Service capacity (to 0.8 Volts / cell): 1250 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 3-312 (size "AAA")
Jacket: Plastic Label
Shelf Life: 7 years

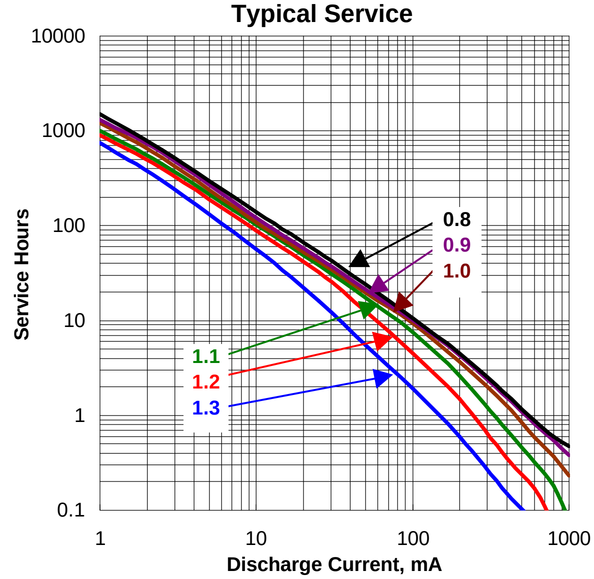
Temperature Effects
Typical Service to 0.8 Volts



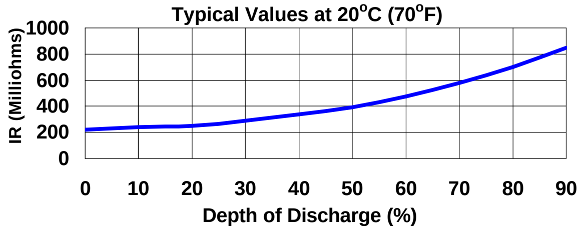
Constant Resistance Discharge
Typical Service



Constant Current Discharge
Typical Service

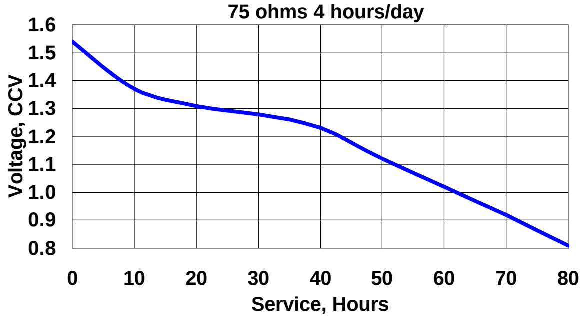


Internal Resistance
Typical Values at 20°C (70°F)

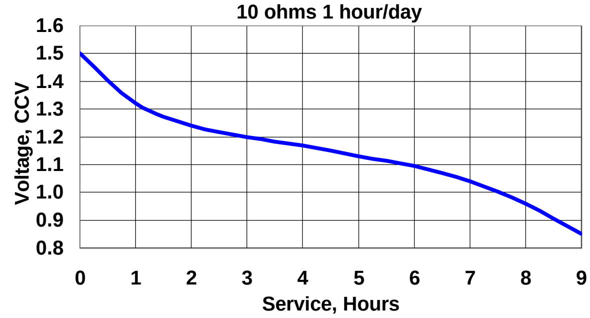


Typical Applications

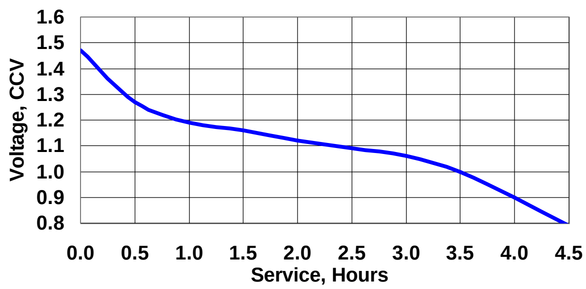
Radio
75 ohms 4 hours/day



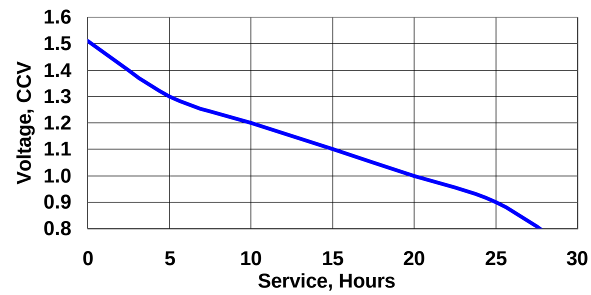
Tape Recorder
10 ohms 1 hour/day



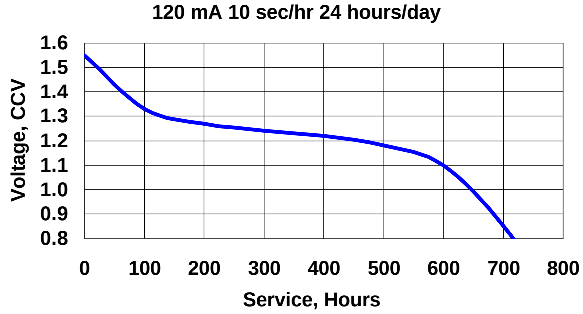
Portable Lighting
5.1 ohms 4 min/hour, 8 hours/day



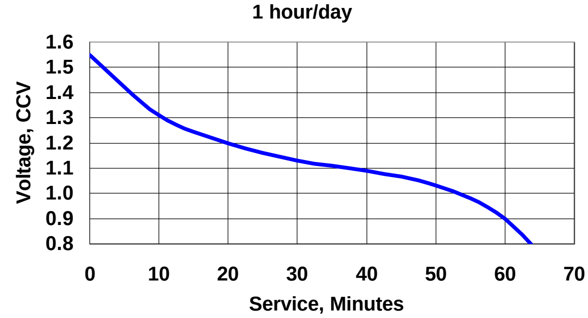
Remote
24 ohms 15 seconds/day 24 hours/day



Pager
1.2 mA Background
120 mA 10 sec/hr 24 hours/day



Photoflash
600 mA 10 sec/min
1 hour/day



Important Notice

This data sheet contains information specific to batteries manufactured at time of its publication. Please contact your Energizer representative for most current information. Contents herein do not constitute a warranty.

E92

Eveready Battery Company, Inc.

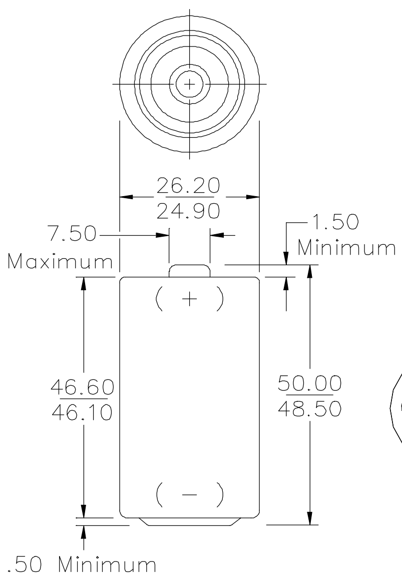
533 Maryville University Drive
St. Louis, MO 63141
Telephone 1-800-383-7323
Internet: www.energizer.com

Engineering Data

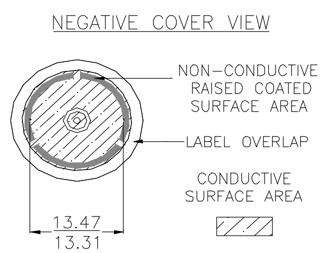
C
Alkaline **1.5V**
No Added Mercury or Cadmium

ENERGIZER NO. E93

Dimensions (mm)



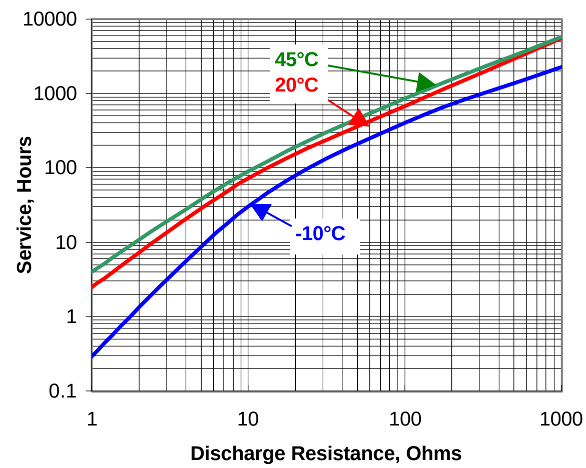
Millimeters	Inches
0.50	0.020
1.50	0.059
7.50	0.295
13.31	0.524
13.47	0.530
24.90	0.980
26.20	1.031
46.10	1.815
46.60	1.835
48.50	1.909
50.00	1.969



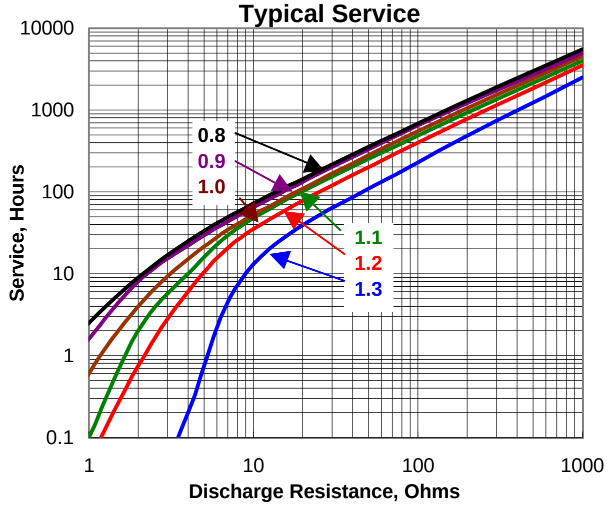
Chemical System: Zinc-Manganese Dioxide (Zn/MnO_2)

Designation: ANSI-14A, IEC-LR14
Battery Voltage: 1.5 Volts
Average Weight: 66.2 grams (2.3 oz.)
Volume: 26.9 cubic centimeters (1.6 cubic inch)
Average Service capacity (to 0.8 Volts / cell): 8350 mAh
(Rated Capacity at 25 mA continuous drain)
Cell: One No. 3-335 (size "C")
Jacket: Plastic Label
Shelf Life: 7 years

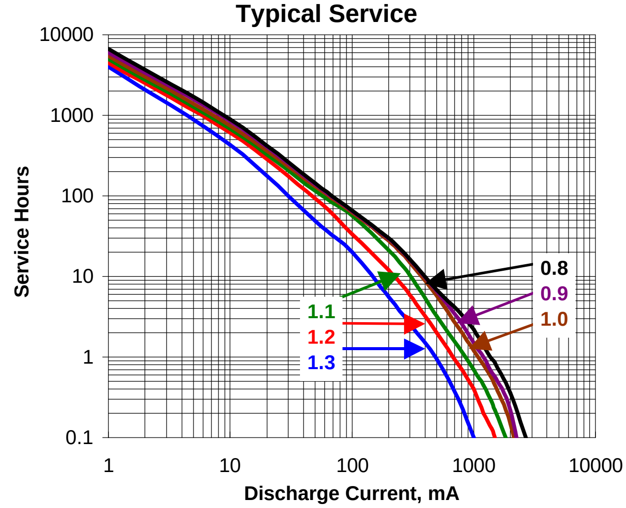
Temperature Effects
Typical Service to 0.8 Volts

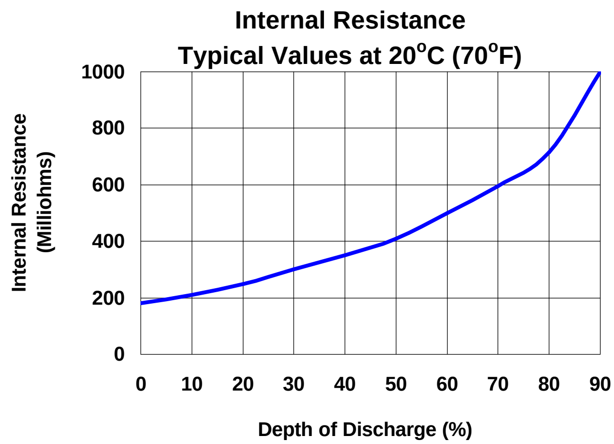


Constant Resistance Discharge
Typical Service

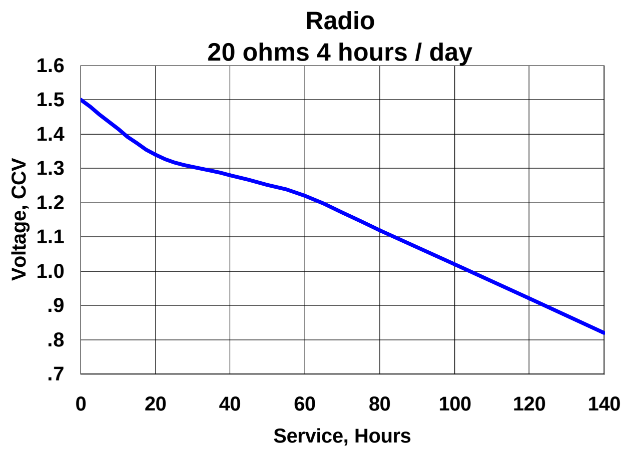


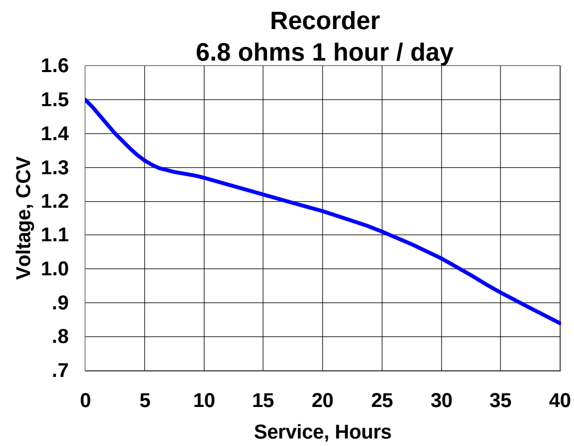
Constant Current Discharge
Typical Service

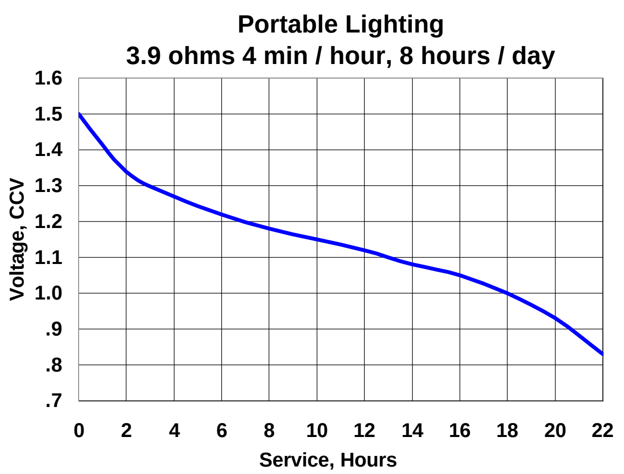


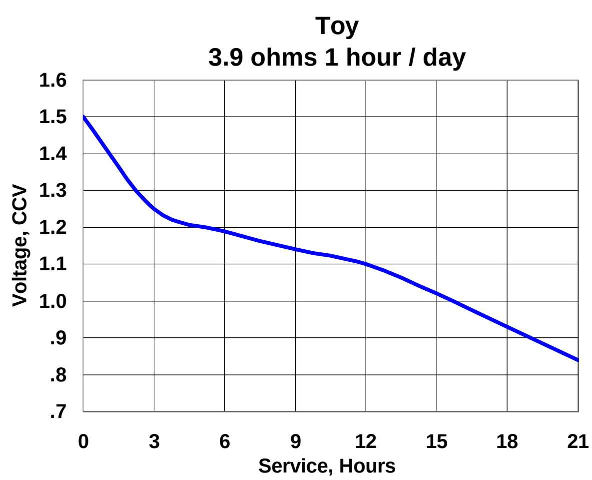


Typical Applications









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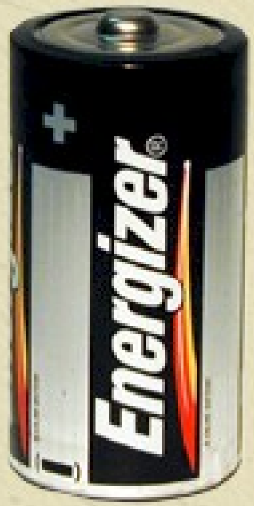
Back to Alkaline Consumer / OEM Table



E93

Home Primary Recharg. Glossary Comments Site Map

Back to Alkaline Consumer / OEM Table

E95

Back to Index Printer Friendly Version

Eveready Carbon Zinc (Zn/MnO_2) Batteries

Table of Contents:

Eveready carbon zinc batteries are marketed in two basic categories--Classic and Super Heavy Duty. The Classic category, our least expensive battery line, is most appropriate for light to moderate periodic power needs or occasional use. The Super Heavy Duty category, premium carbon zinc, performs better than the Classic category on moderate to heavy drains or continuous drains.

Two electrochemical systems are used in Eveready carbon zinc batteries--LeClanche and Zinc Chloride. Classic product is often but not always, constructed using the LeClanche system. Super Heavy Duty product is usually, but not always, constructed using the Zinc Chloride system.

For several years, Eveready Battery Company has aggressively pursued the reduction of heavy metals in all carbon zinc batteries. All of the batteries described in this data book, with the exception of a few which are noted, have no added mercury or cadmium. If further information is needed, consult your Eveready salesperson.

The decision on whether to use the LeClanche or Zinc Chloride system in manufacturing a battery is determined after careful consideration of various device power requirements. The individual data pages that can be found in the attached Adobe .pdf files indicate whether the battery is in the Classic or Super Heavy Duty category and its electrochemical system.

System Description:

Carbon Zinc: A generic term for primary dry batteries of the LeClanche or Zinc Chloride system. These batteries have an anode of zinc, a cathode of manganese dioxide, and a slightly acidic electrolyte.

LeClanche: A carbon zinc battery with a slightly acidic electrolyte consisting of ammonium chloride and zinc chloride in water.

Zinc Chloride: A carbon zinc battery with a slightly acidic electrolyte consisting mainly of zinc chloride in water.

Carbon zinc batteries provide an economical power source for devices requiring light to moderate drain because of the use of inexpensive materials and their time proven constructions. Eveready Battery Company manufactures both LeClanche and Zinc Chloride carbon zinc batteries that differ in price, capacity, and rate capability. All Eveready Battery Company carbon zinc cells are primary batteries and therefore are not designed for recharging.

The service capacity of a carbon zinc battery is not a fixed number of ampere hours because the battery functions at different efficiencies depending upon the conditions imposed upon it. The service varies with current drain, operating schedule, and cutoff voltage. The battery is also affected by the operating temperature and storage conditions.

The general characteristics of an Eveready Battery Company LeClanche battery are:

- Less expensive than alkaline or Zinc Chloride. Economical in terms of cost per hour of use on light current drains.
- The widest variety of shapes, sizes, and capacities within the primary battery system. Available in voltages ranging from 1.5 volts to 510 volts.
- Energy density of approximately 1-2 watt hours per cubic inch.
- Average service maintenance exceeds 90% after one year storage at 21°C on typical tests.
- Lower unit weight than alkaline.
- Sloping discharge curve.
- Output capacity decreases as the battery is discharged.
- Performance reduced at low temperatures.
- Sensitive to changes in the discharge rate and/or use frequency.

The general characteristics of an Eveready Battery Company Zinc Chloride battery are:

- Less expensive than alkaline. Economical in terms of cost per hour on moderate current drains or use frequency.
- Less output capacity decrease than LeClanche as the drain rate increases.
- Less sensitive than LeClanche to changes in the discharge rate and/or duty cycle.
- Lower internal resistance than LeClanche.
- Better low temperature performance than LeClanche.
- Energy density of approximately 2 to 2.5 watt hours per cubic inch.
- Average service maintenance exceeds 90% after one year storage at 21°C on typical tests.
- Higher open circuit and initial closed circuit voltage than LeClanche or alkaline.
- Lower unit weight than alkaline.
- Available in voltages ranging from 1.5 volts to 12 volts and in a variety of shapes and sizes.
- Sloping discharge curve.

Battery Construction:

The carbon zinc battery uses a zinc anode, a manganese dioxide cathode, and an electrolyte of ammonium chloride and/or zinc chloride dissolved in water. Powdered carbon is used in the cathode mix, usually in the form of carbon black to improve conductivity of the mix and for moisture retention.

Carbon zinc batteries are produced in two general configurations:

- Cylindrical--available as unit cells or in assembled multi-cell batteries

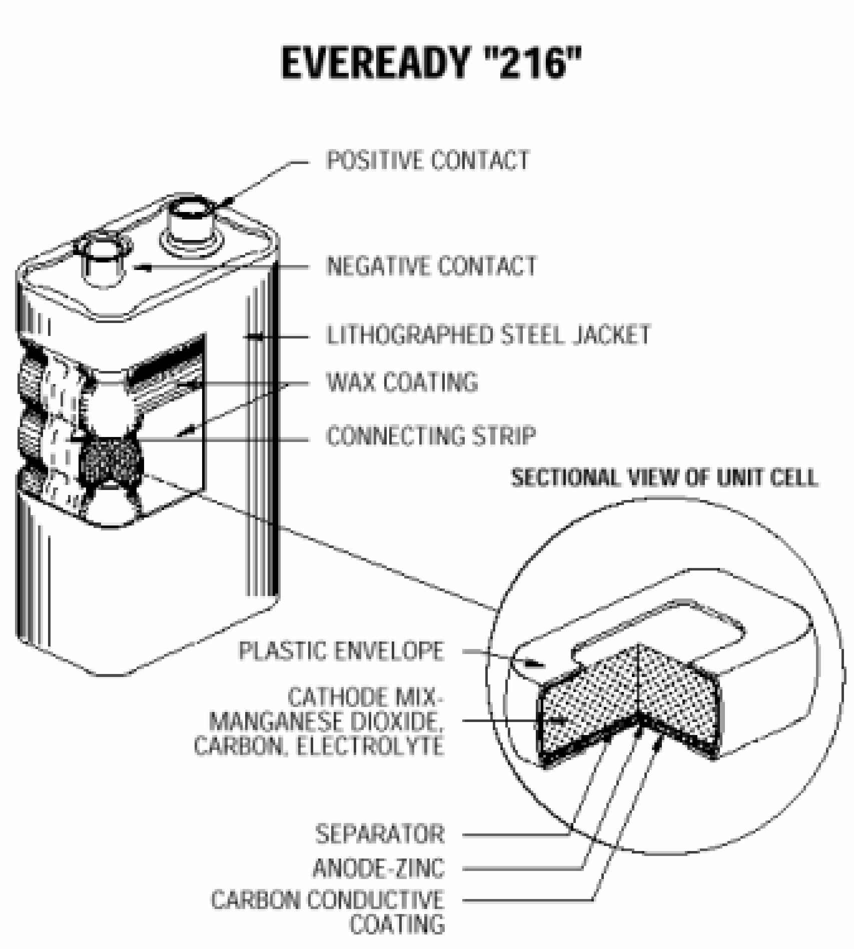
- Flat--available in multi-cell batteries only

Within the carbon zinc cylindrical battery category are two constructions: LeClanche and Zinc Chloride. The Zinc Chloride battery contains proportionately more zinc chloride in the electrolyte than the LeClanche battery and therefore requires different battery design as shown in the following diagram:

Click here for Carbon Zinc Cylindrical Battery Cross Section
(Adobe .pdf File)

Cathodes are a mixture of manganese dioxide, carbon conductor and electrolyte.
Anodes are zinc alloy can. The can also confines the active materials in the battery.
Separators are flour/starch paste or coated paper selected to prevent migration of solid particles in the battery.
Carbon electrode serves as the cathode current collector.
Top and bottom covers provide contact surfaces of plated steel.
The outside of the battery is covered with plastic film, Kraft paper and a printed plastic label.
Asphalt or plastic closure acts as the battery seal. Venting mechanisms are incorporated in the battery either through the carbon electrode or plastic seal.

Flat cells used in the construction of 9 volt batteries are of the LeClanche system. The flat cell contains no voids or carbon rod as does the cylindrical battery. The flat cell, because of its rectangular form, reduces wasted space in assembled batteries. The energy to volume ratio of a multi-cell battery utilizing cylindrical cells is decreased by the voids occurring between the cells. These two factors account for substantially higher energy volume ratio for flat cell batteries when compared to batteries consisting of cylindrical cells. The cutaway of a typical Eveready flat cell battery is shown here:



Click here for Cross Section (Adobe .pdf File)

Typical Eveready Flat Cell LeClanche Components

- Cathodes are a mixture of manganese dioxide, carbon conductor and electrolyte.
- Anodes are zinc alloy sheets.
- Separators are specially selected to prevent migration of solid particles in the cell.
- Plastic envelope confines active cell materials.
- Carbon conductive coating on the zinc anode serves as the cathode collector for the adjacent cell.
- Wax coating provides the battery seal.
- Connector strips connect the flat cell stack to the battery terminals.
- Lithographed steel jacket is electrically insulated from battery components.
- Specialized terminals provide positive and negative external contact surfaces.

Electro-Chemistry:

LeClanche

The performance of a LeClanche battery is the result of an electrochemical reaction between:

- A cathode composed of carbon and refined manganese dioxide which may contain some naturally occurring manganese dioxide. The more pure the cathode material, the better the performance. (The carbon component of the cathode is usually carbon black and provides increased conductivity and moisture retention.)

- An anode of high purity zinc alloy.
- A highly conductive, slightly acidic, electrolyte solution of ammonium chloride and zinc chloride in water.

The chemical equation for this reaction is:

$2MnO_2 + 2NH_4Cl + Zn \rightarrow ZnCl_2{\bullet}2NH_3 + Mn_2O_3 + H_2O$

Zinc Chloride

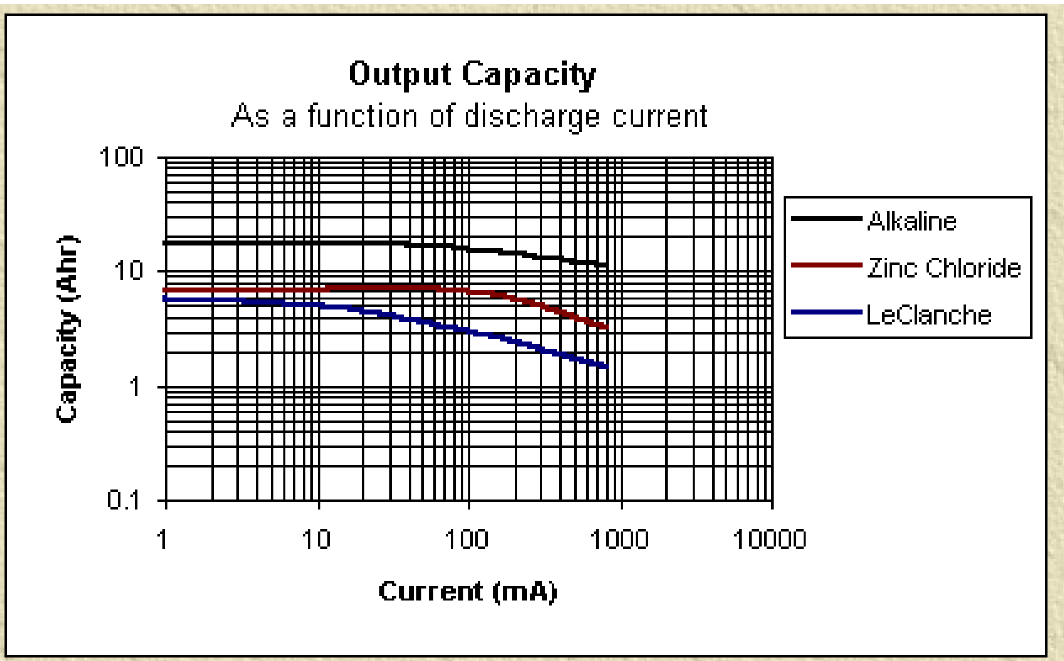
The performance of a Zinc Chloride battery is the result of an electrochemical reaction between:

- A cathode composed of carbon and refined manganese dioxide which may contain some naturally occurring manganese dioxide.
  a. The carbon component of the cathode is usually carbon black and provides increased conductivity and moisture retention.
  b. Typically, Zinc Chloride batteries have a higher proportion of carbon to manganese dioxide than LeClanche.
- An anode of high purity zinc alloy.
- A highly conductive, slightly acidic, electrolyte solution of zinc chloride in water which may contain a small amount of ammonium chloride.
  a. A Zinc Chloride battery contains a greater volume of electrolyte than the same size LeClanche battery.
  b. The electrolyte is slightly more acidic than a LeClanche electrolyte.

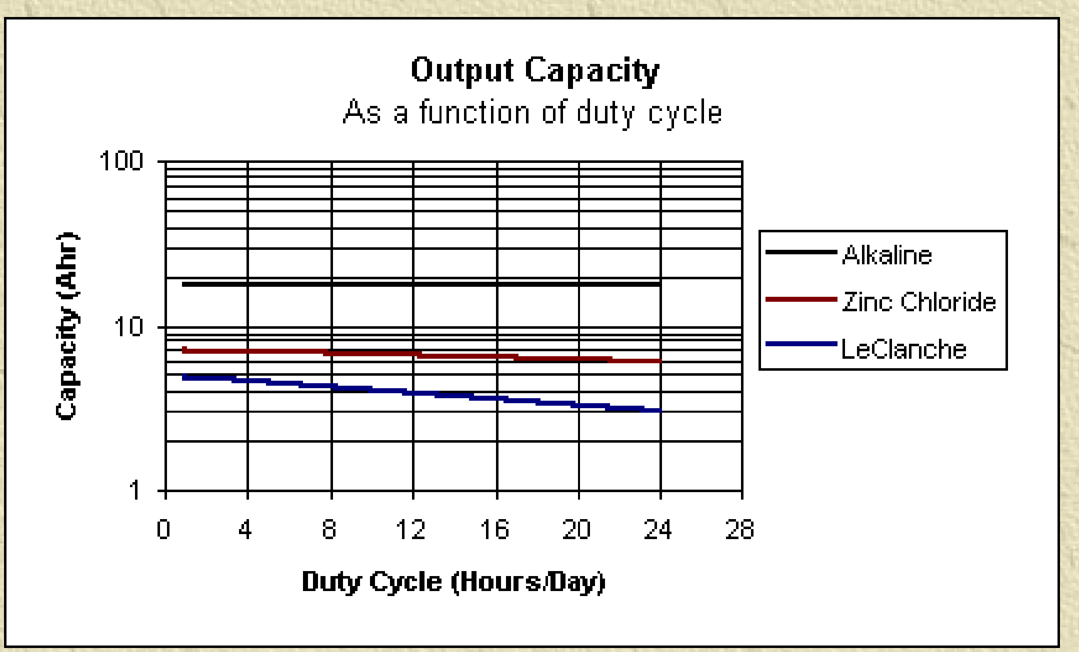
The chemical equation of this reaction is:

$8MnO_2 + 4Zn + ZnCl_2 + 9H_2O \rightarrow 8MnOOH + ZnCl_2{\bullet}4ZnO{\bullet}5H_2O$

The open circuit voltage of a fresh LeClanche Battery is typically over 1.55 volts. A Zinc Chloride battery is typically over 1.60 volts. The closed circuit voltage declines gradually as a function of the depth of discharge. The energy output of Zinc Chloride batteries is less sensitive to variations in the discharge current and duty cycle than comparable size LeClanche batteries. Typical D size performance to a 0.75 volt cutoff is shown in the following diagrams:



The efficiency of a carbon zinc or alkaline battery improves as the current drain decreases as seen in the above graph. This is more dramatically seen in the LeClanche and Zinc Chloride systems. As a result, an important application guide-line should be considered: "For increased efficiency, use as large a battery as possible, consistent with the physical limitations of the device." This has the same effect as lowering the current. As an example, doubling the size of a carbon zinc battery will more than double the service life at a given drain.



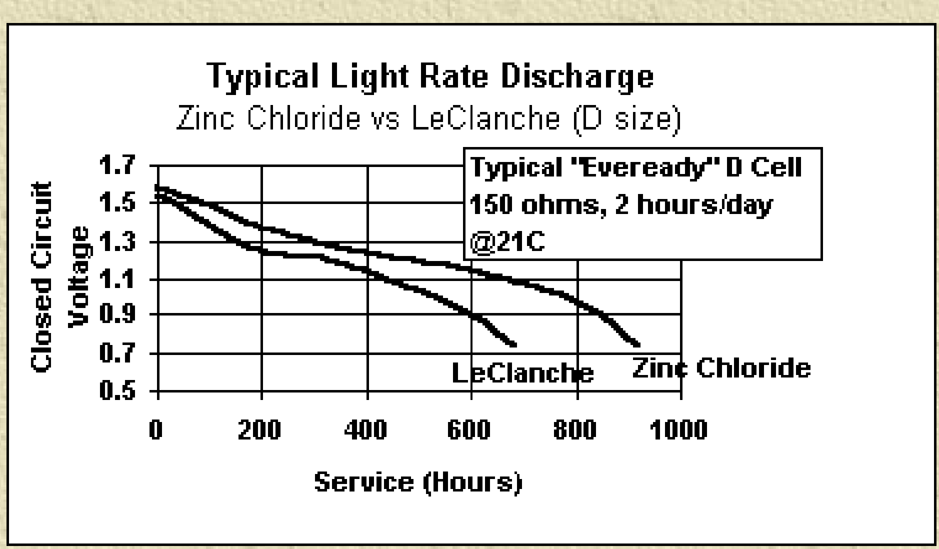
The electrochemical inputs of cylindrical D size batteries typically are in a ratio of 2:3:5 for LeClanche, Zinc Chloride and Alkaline respectively. The differences in efficiency and rate sensitivity between the three systems cause variations in actual output in simulated typical applications as shown in the following table and graph:

Eveready D Size
Typical Percent

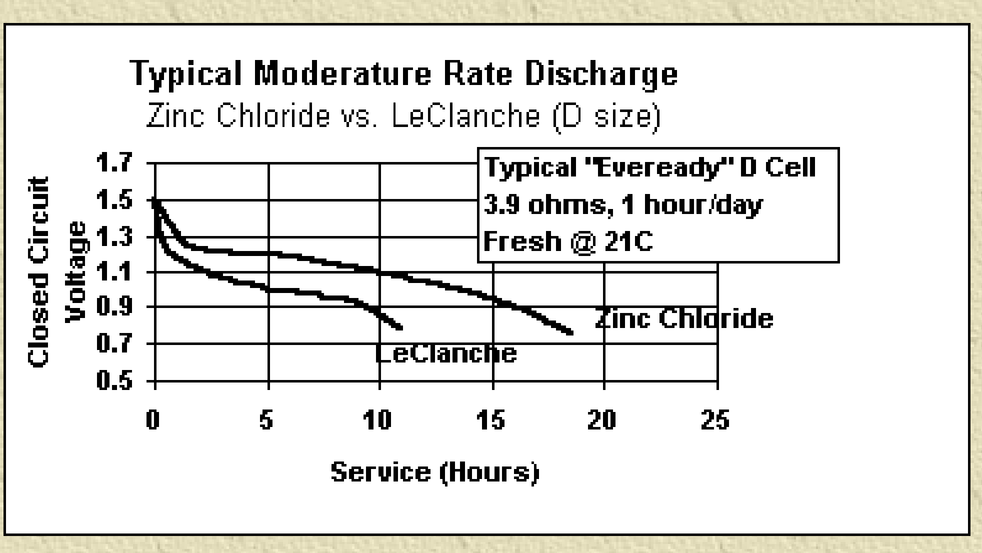
of LeClanche Service

Test	Load (Ohms)	Duty Cycle	LeClanche	Zinc Chloride	Alkaline
Motor Toy	2.2	Continuos to 0.8 V	100%	300%	1100%
Cassette	10	4hrs/day to 0.9V	100%	250%	570%
Flashlight	2.2	4 min/hr 8 hr/day to 0.9V	100%	200%	460%
Radio	24	4 hr/day to 0.9 V	100%	180%	405%

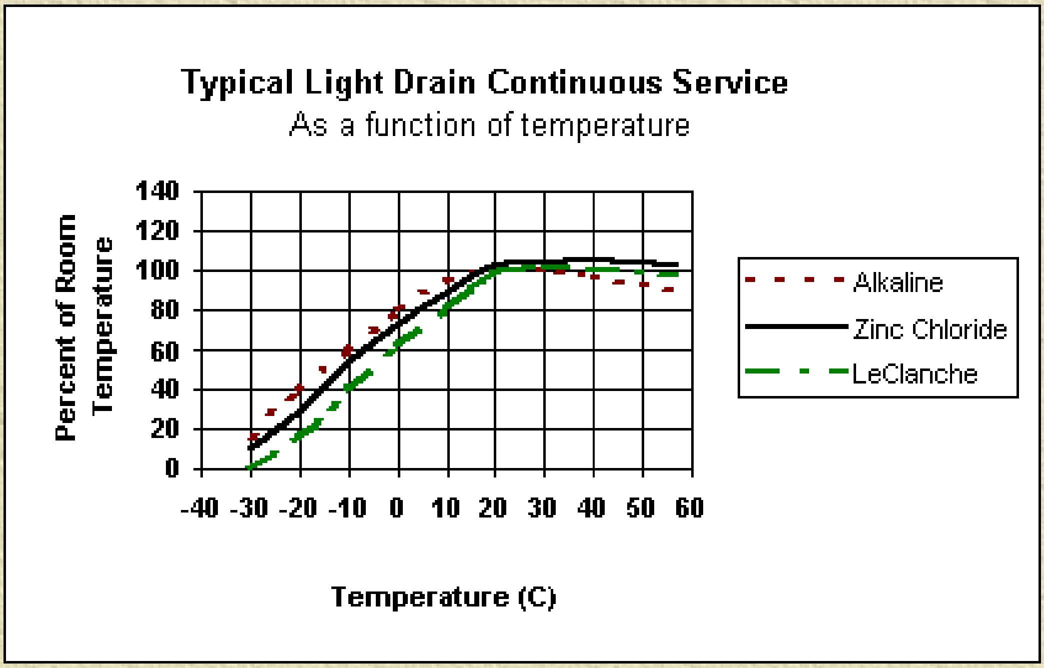
Carbon Zinc batteries are more efficient when used in low rate applications as shown in the curve below. Typical carbon zinc light drain is defined as a current that would discharge the battery after 50 or more hours of use at room temperature.



As the drain is increased, the service difference between Alkaline, Zinc Chloride and LeClanche systems increases. This relationship is shown by the following discharge curves. Typical carbon zinc moderate drain is defined as a current that would discharge the cell within 10-50 hours of use at room temperature.



Temperature
Changes in temperature will affect the reactivity of battery chemical components. The typical effect on service of a D size cylindrical battery to a 0.75 volt cutoff is shown in the following diagram:



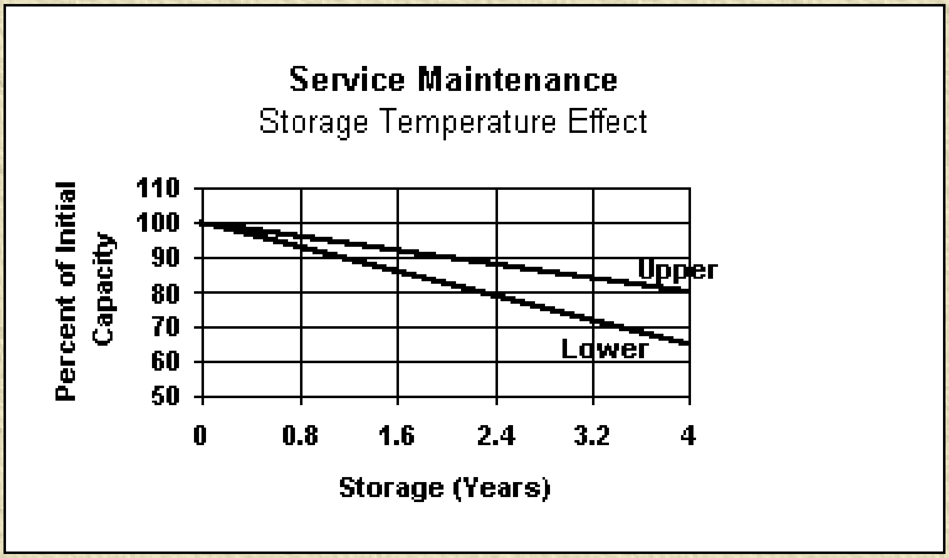
Light Drain is defined as a current that would discharge the battery after 50 or more hours of use at room temperature.

Heavier Drains at low temperature will tend to decrease the percent service from that shown in the above diagram. The LeClanche system is affected most, Zinc Chloride moderately, and Alkaline the least as the drain increases. The service on all drains at high temperatures over time is eventually reduced by an increase in self discharge.

Eveready carbon zinc batteries provide good service maintenance due to time tested construction, quality control of materials and close monitoring of batteries during assembly.

Time of Storage (21°C)	Typical Percent of Fresh Cell Service Retained
1 year	100-95%
2 years	82-90%
3 years	74-85%
4 years	65-80%

The storage of carbon zinc batteries at temperatures below 21°C will increase their service maintenance. While freezer storage (-20°C) of a carbon zinc battery is not harmful, storage at 5 to 10°C is effective. Batteries to be stored at low temperature storage should be allowed to reach room temperature in their packing so as to avoid condensations of moisture which may cause electrical leakage and/or destruction of the jackets. Storage at high temperatures exceeding 21°C for sustained periods of time will significantly reduce service maintenance. The typical effects of storage temperature on carbon zinc service maintenance are shown in the following diagram:



Internal Resistance:

The internal resistance (R_j) of a battery is its opposition to the flow of current. In all cases, this resistance increases as the temperature of a battery decreases. While the R_j will vary with load for the battery size, it will be higher for LeClanche than Zinc Chloride which in turn will also be higher than Alkaline. The R_j of a cylindrical carbon zinc battery increases gradually until it approaches the end of service life and then increases rapidly.

Internal resistance is typically measured in one of two ways:

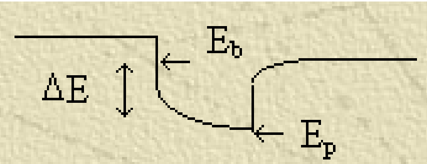
1. As a reduction in closed circuit voltage when the applied load is increased (voltage drop method).
2. As a maximum short circuit current (flash amperage).

The voltage drop method in determining the effective internal resistance is also used by ANSI.

The R_j values obtained by either method of measurement are subject to number of variables and operator techniques. The effective R_j values shown on the data pages were calculated by the voltage drop method as this more accurately projects the batteries current carrying capability in actual device applications. This calculation involves placing a battery on a constant background load, allowing it to stabilize and then pulsing it with a heavier load for one second. The resulting voltage drop is then measured and expressed in terms of Ohms as shown in the following example.

Determination of Internal Resistance (R_j)
Voltage Drop Method

R_i = Internal Resistance
R_b = Resistance of Background Load
E_b = Background Voltage
R_p = Resistance at Pulse Load
E_p = Voltage at end of pulse
ΔE = Voltage Change
ΔI = Current Change
I_b = Background Current
I_p = Current at End of Pulse



$$I_b = \frac{E_b}{R_b}$$

$$I_p = \frac{E_p}{R_p}$$

$$R_i = \frac{\Delta E}{\Delta I} = \frac{E_b - E_p}{I_p - I_b}$$

Although flash amperage does not indicate battery freshness or potential service, circuit designers should be aware of the maximum current that a battery could supply if a component failure occurs. The following are typical maximum flash amperage values for Eveready carbon zinc batteries. These flash amperage values can vary widely without affecting battery service in actual applications.

Carbon Zinc Battery Size	Typical Maximum Flash Amperage	
	LeClanche	Zinc Chloride
D	6	9
C	5	7
AA	5	5
AAA	5	3
9V	0.6	----

Applications
Eveready carbon zinc batteries will meet a wide variety of device applications utilizing light to moderate drains, such as:

- Alarm Systems
- Barricade Flashers
- Boom Boxes
- Calculators
- Clocks
- Communications equipment
- Electrical fence controllers
- Electronic games
- Flashlights
- Fluorescent lanterns
- Garage door openers
- Home entertainment remote controls
- Kerosene heater igniters
- Home security devices
- Laboratory instruments
- Lanterns
- Marine depth finders
- Motion displayers
- Motor driven devices
- Penlights
- Personal care devices

- Portable tape recorders and players
- Radios
- Radio controlled toys
- Remote control transmitters
- Small lighted toys and novelties
- Smoke detectors (only when recommended by manufacturer)
- Specialty High voltage electronic photo flash
- Stereo headsets
- Test equipment
- Toys

Back to Top of Page

Back to Index Printer Friendly Version

Energizer Lithium L91 Battery

Application Manual

Click on section 'bookmarks' below or scroll down.

L91 Introduction

This manual contains general information and data that reflects a specific battery in production at the time of preparation. Since the characteristics of individual batteries are sometimes modified, persons and businesses that are considering the use of a particular battery should contact the nearest Energizer Sales office for current information. None of the information in this manual constitutes a representation or warranty by Eveready Battery Company, Inc. concerning the specific performance or characteristics of the battery.

Battery Selection

The following provides the characteristics and general guidelines for selection of the L91 Lithium / FeS2 battery:

Advantages

Can be used in any application that uses other AA size 1.5 volt battery types

Higher operating voltage and flatter discharge curve than other AA size 1.5 volt battery types

- Longer service than other AA size 1.5 volt battery types, especially in moderate to heavy drain applications
- Even greater service advantage over other 1.5 volt types at low temperatures: will work at temperatures at which other types will not
- Much better leakage resistance than other 1.5 volt types
- Performs well after up to 10 years storage
- Much lighter weight - 1/3 less than AA alkaline
- Good service maintenance after high temperature storage
- No added mercury, cadmium, or lead

Limitations

- Maximum storage and operating temperatures are limited by jacket shrinkage: no problems at 60° C, can tolerate 71° C for at least 1 week without exposing the bare cell
- Maximum discharge current is limited by the resettable safety switch; see section on safety switch for details

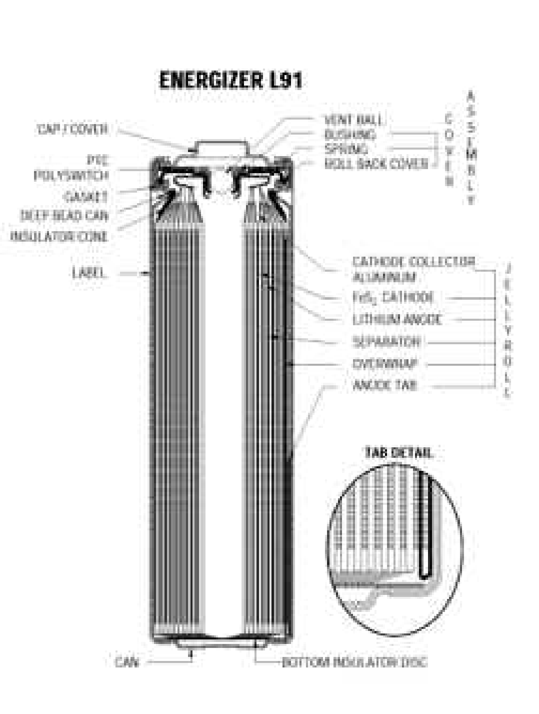
AA Primary Cylindrical Cells

System		**E91 Alkaline** **Zn/MnO2**	**L91 Lithium** **Li/FeS2**
Battery Weight (Grams) Voltage	 Nominal	23.0 1.5	14.5 1.5
	Open Circuit	1.6	1.8
Operating Time	1400mA	0.2	1.3
(Hours to 0.90 Volt)	1000mA	.04	2.1

	400mA	2.7	5.7
	20mA	117.0	122.0
1kHz Impedance (Ohms)		0.17	0.18
Shelf Life (Years)		7.0	10.0

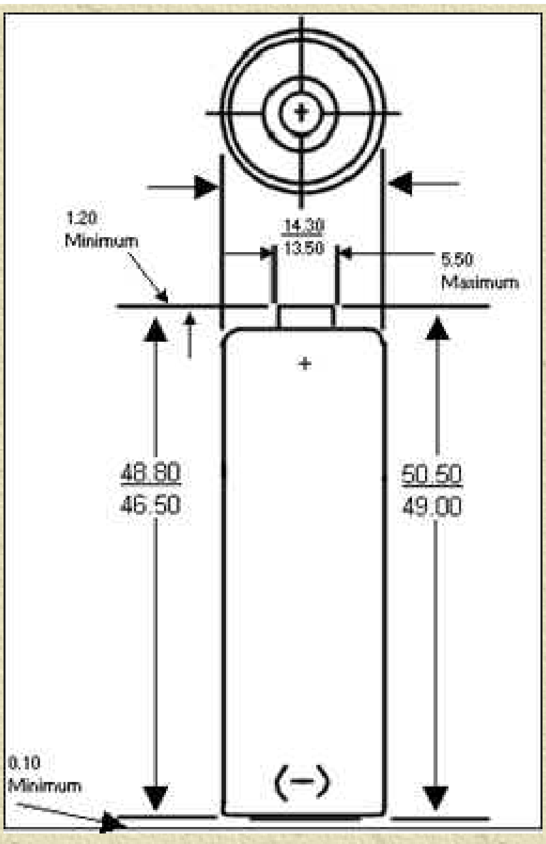
L91 Engineering Data

(Back to Top)



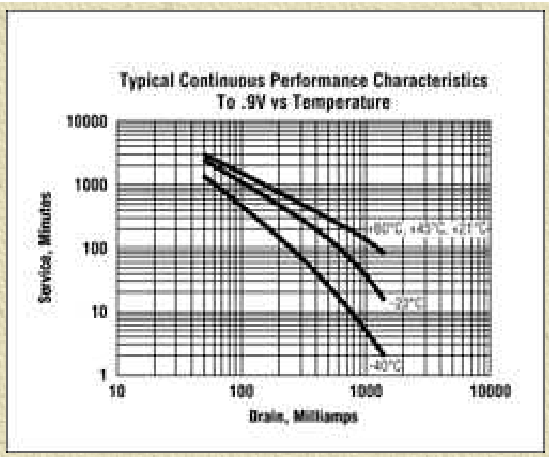
Click here for PDF version.

DIMENSIONS (mm)



Millimeters	Inches
0.10	0.004
1.20	0.047
5.50	0.217
13.50	0.531
14.30	0.563
46.50	1.831
48.80	1.921
49.00	1.929
50.50	1.988

Voltage Taps: -, + 1.5
Terminals: Flat Contacts
Average Weight: 14.5 grams (0.51 oz.)
Volume: 8.0 cubic centimeters (0.49 cubic inch)
Storage Temperature Range: -40° C to + 60° C (-40° F to 140° F)
Operating Temperature Range: -40° C to + 60° C (-40° F to 140° F)
Maximum Continuous Discharge Load: 1.4 amps
Lithium Quantity: Less than 1.0 grams (0.04 oz) per cell
Transportation: Meets requirements of 49 CFR 173.185(b) and IATA Special Provision A45



L91 Performance (Back to Top)

Battery Testing

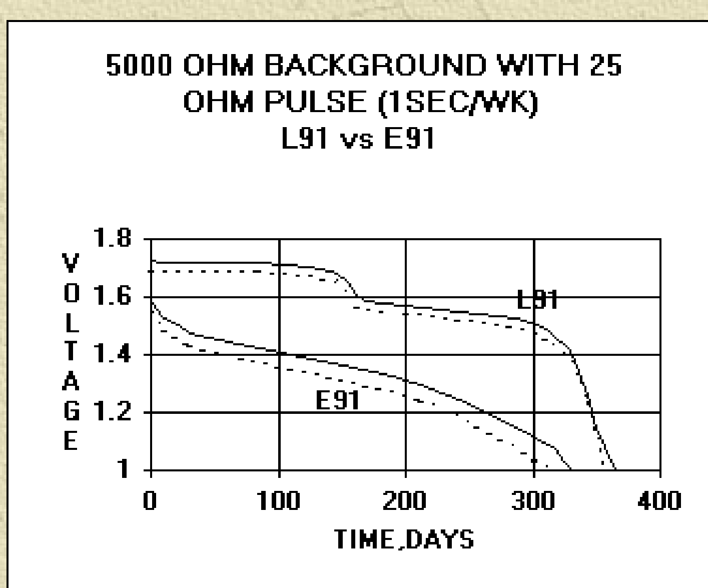
Constant Resistance
Constant Current
Constant Power

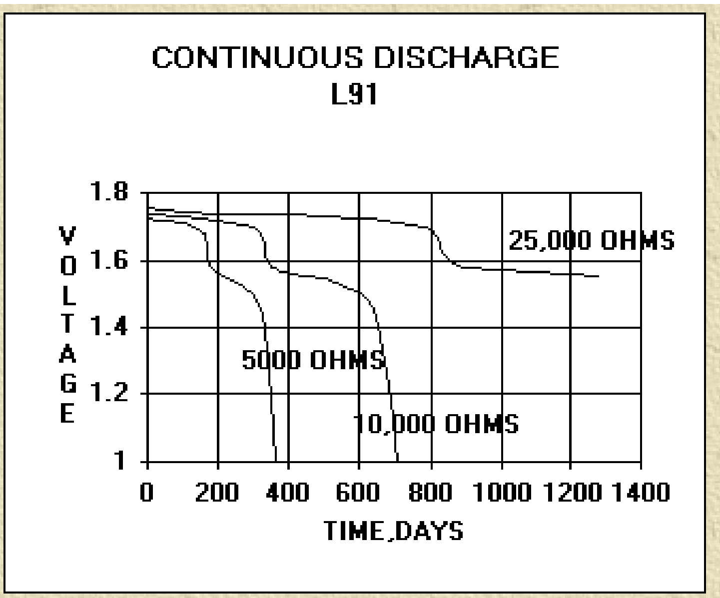
The discharge characteristics of batteries can vary, depending upon whether they are discharged at a constant resistance, constant current or constant power. Very few devices discharge batteries at a constant resistance. More often, they discharge batteries at closer to a constant current or constant power. However, because the test equipment for constant current and constant power testing is more complicated and expensive, constant resistance testing is frequently used where it will give a reasonably accurate estimate of duration.

Because of the significant differences in discharge characteristics for L91 batteries compared to AA alkaline batteries on constant resistance loads, constant resistance testing cannot be universally used to approximate relative L91 and AA alkaline battery durations, especially on heavier drains. On constant resistance discharge, L91 generally maintains a higher operating voltage during discharge. This removes capacity (amp-hours or watt-hours) at a faster rate for L91 than for alkaline batteries. This can result in understanding the L91 duration for constant current and constant power applications.

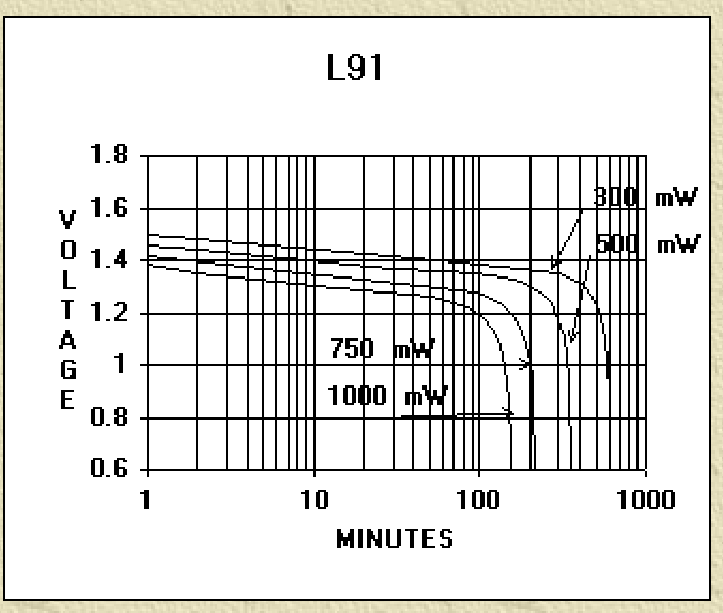
To determine the battery duration for a particular application, it is most reliable to rest the batteries in devices. When this is not practical, simulation testing can be done. If possible, determine whether the device is closest to a constant resistance, constant current or constant power load, and use the type of testing that best approximates the device.

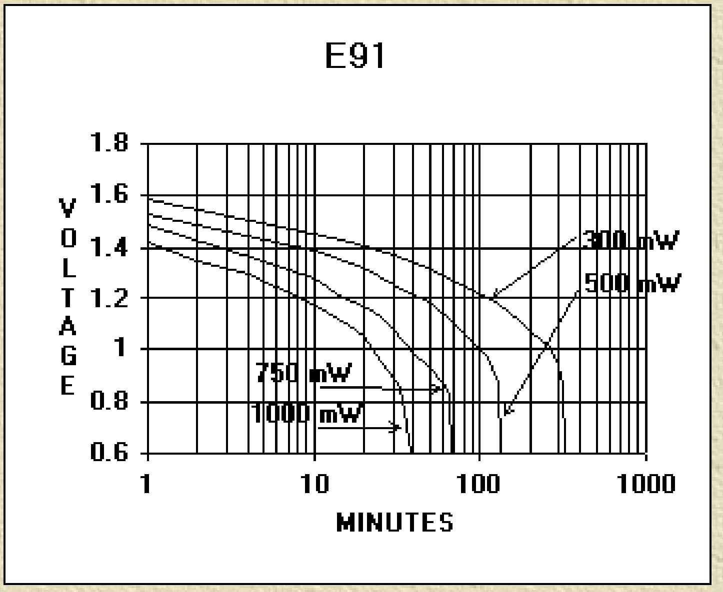
Constant Resistance Discharge @ 21° C





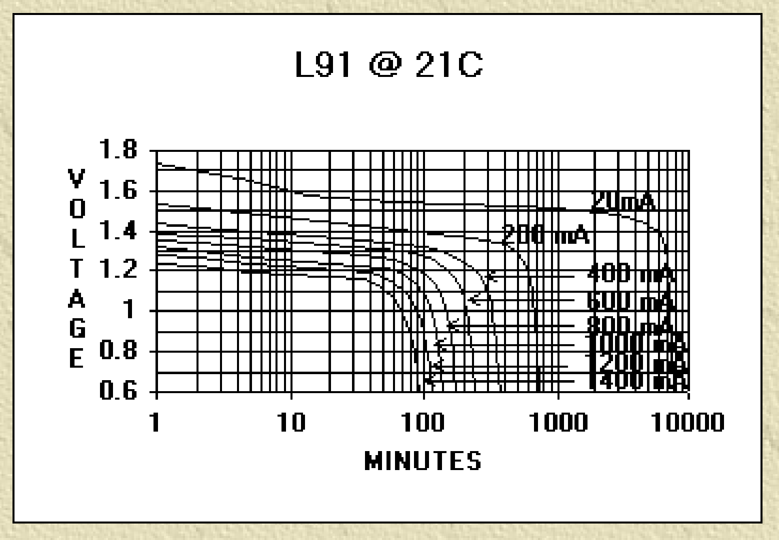
Constant Power Continuous Discharge @ 21° C

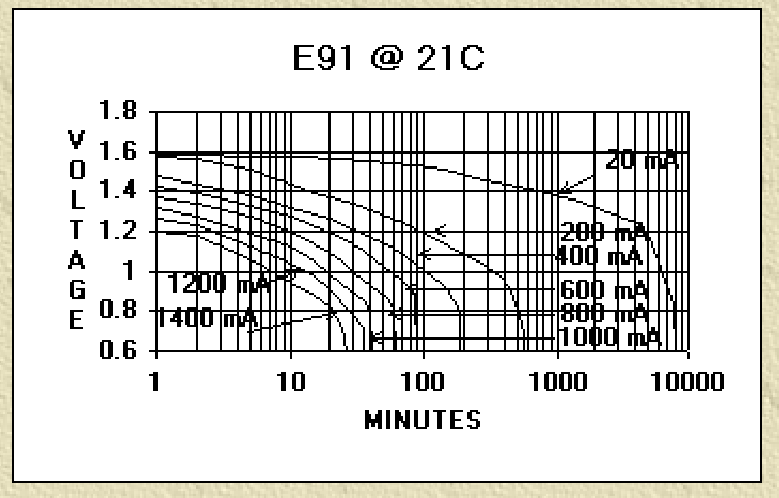


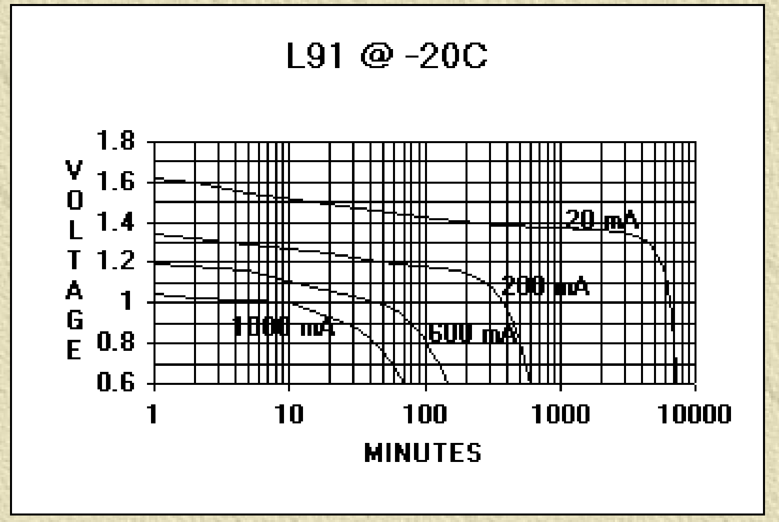


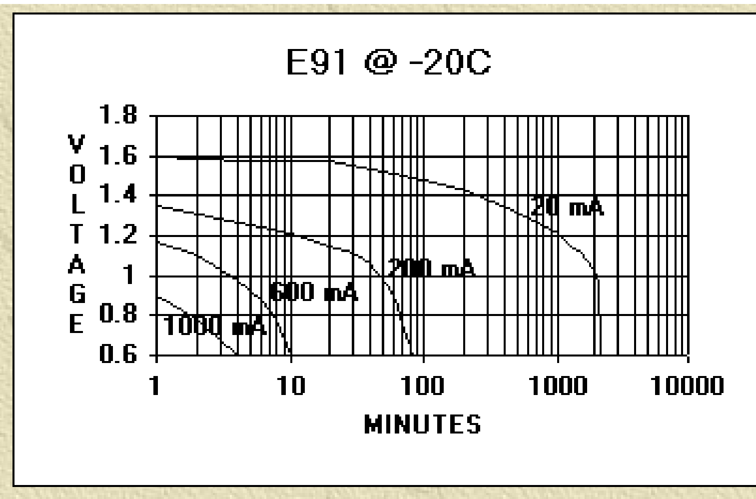
Constant Current Continuous Discharge

L91 vs. E91 - Temperature Effects

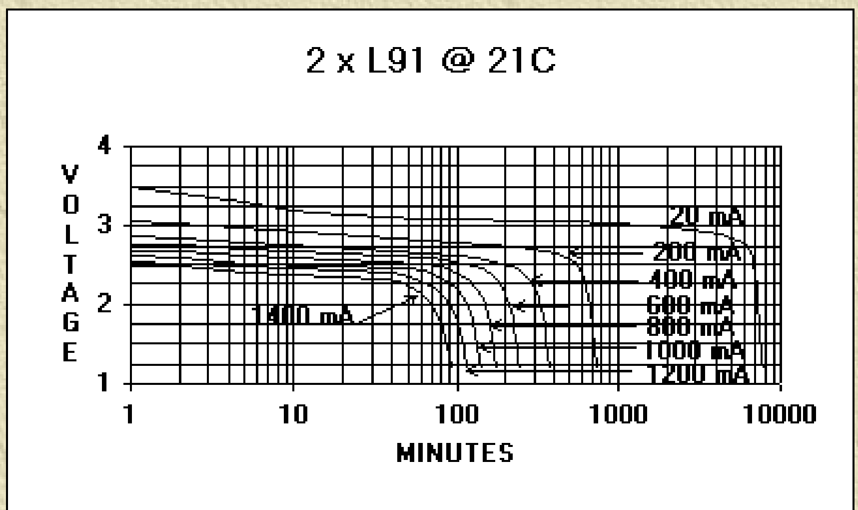

L91 @ 21C
VOLTAGE
1.8
1.6
1.4
1.2
1
0.8
0.6
1
10
100
1000
10000
MINUTES
20mA
200 mA
400 mA
600 mA
800 mA
1000 mA
1200 mA
1400 mA

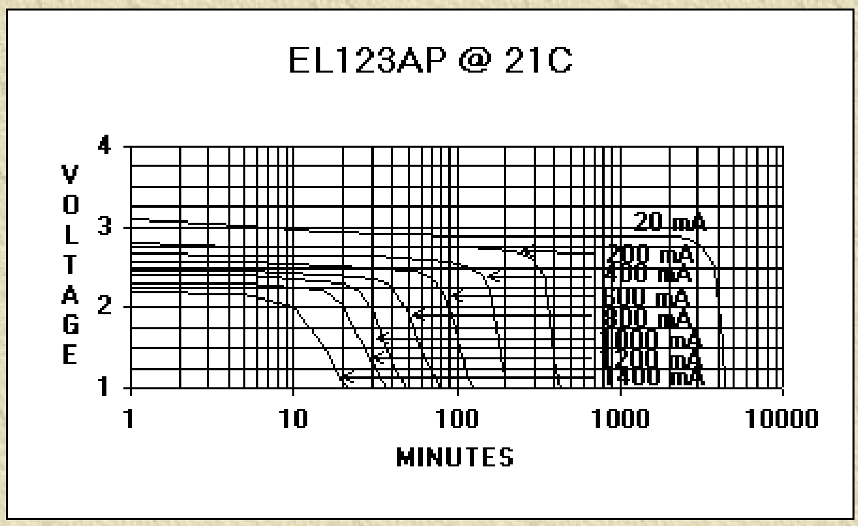

E91 @ 21C
VOLTAGE
1.8
1.6
1.4
1.2
1
0.8
0.6
1
10
100
1000
10000
MINUTES
20 mA
200 mA
400 mA
600 mA
800 mA
1000 mA
1200 mA
1400 mA

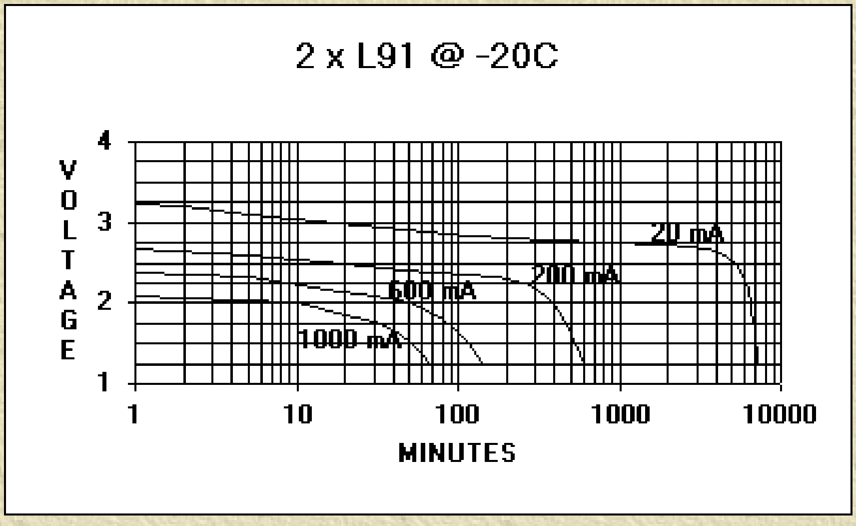

L91 @ -20C
VOLTAGE
1.8
1.6
1.4
1.2
1
0.8
0.6
1
10
100
1000
10000
MINUTES
20 mA
200 mA
600 mA
1000 mA

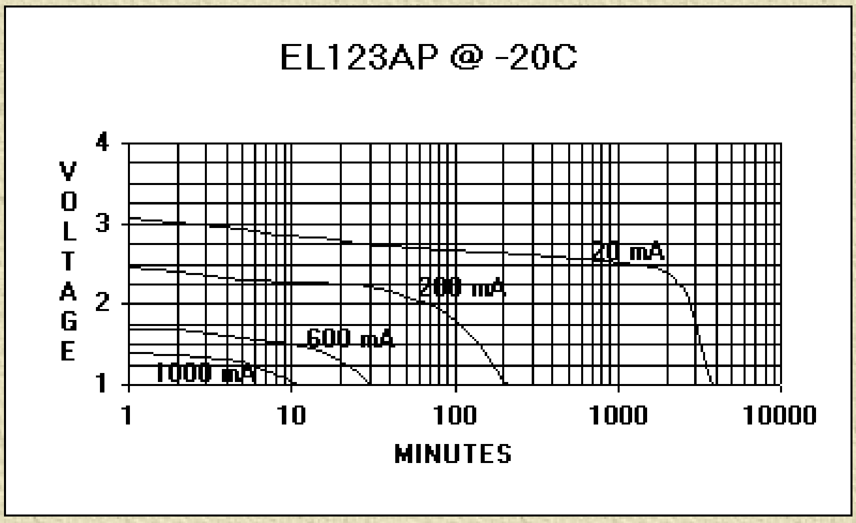


2 x L91 vs. 3 Volt Lithium Photo Battery (EL123AP)

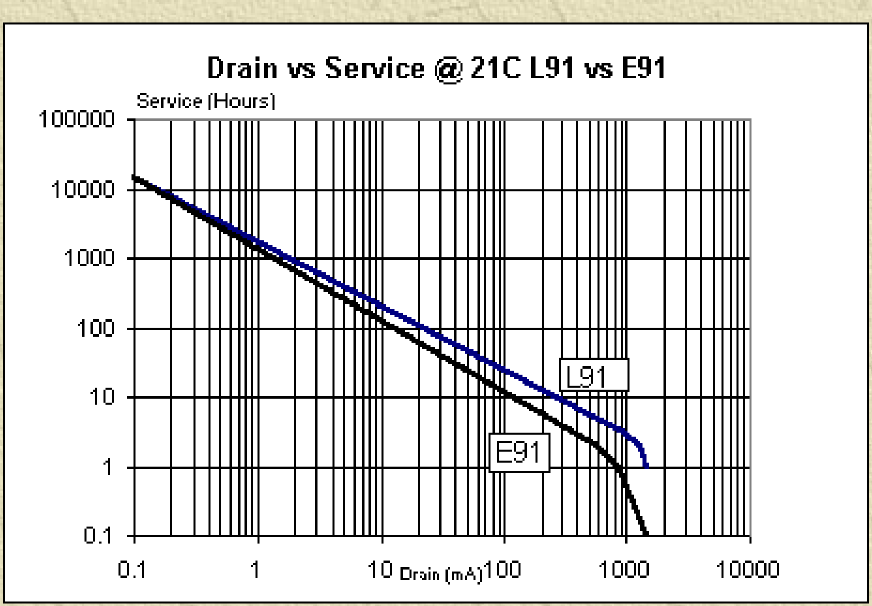


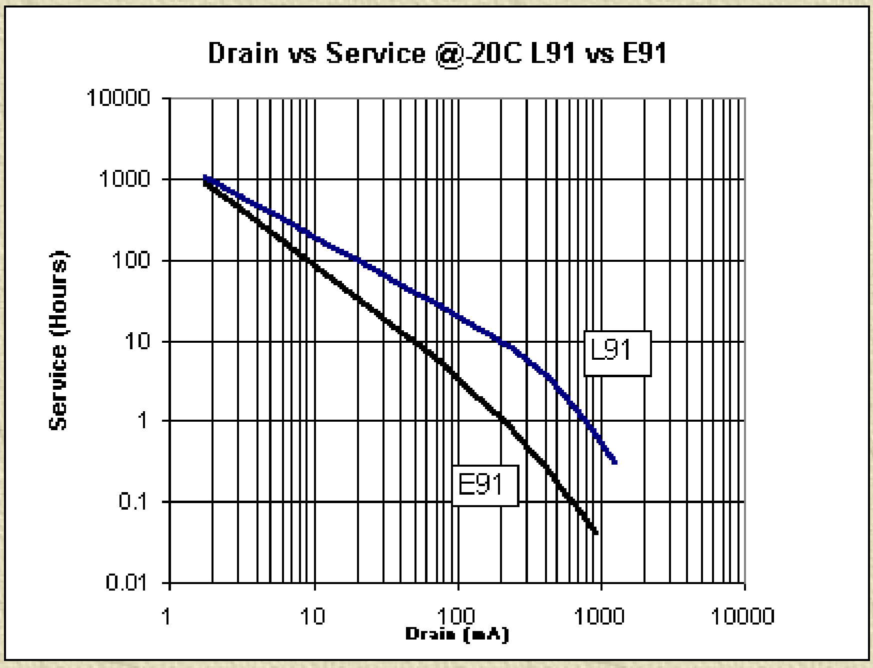


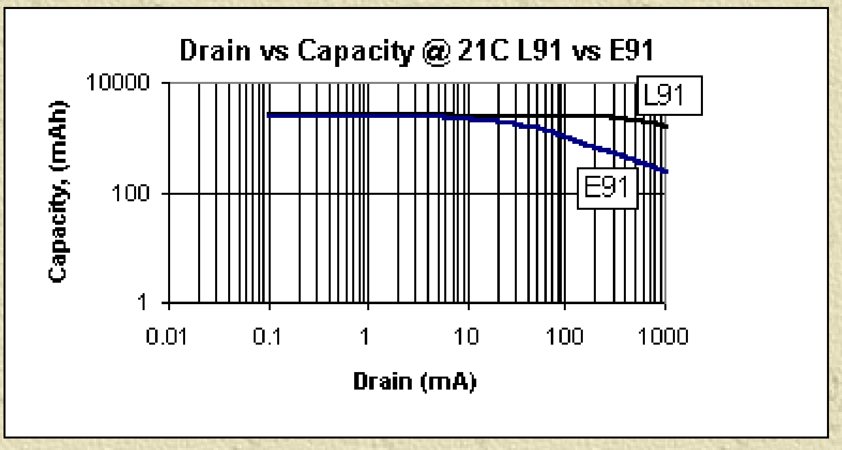


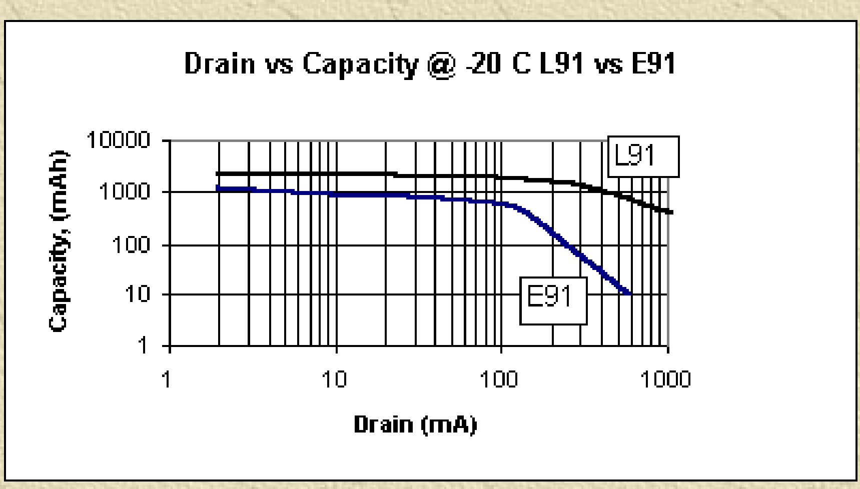


Rate Sensitivity to 0.9 Volts





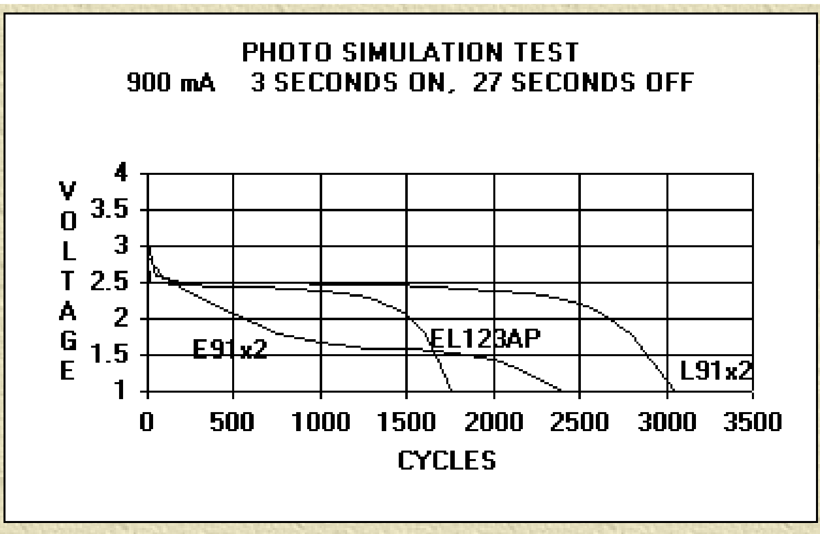




L91 Device Testing

(Back to Top)

Photo Simulation Test
2 x AA vs. 3 Volt Lithium Photo Battery (EL123AP)



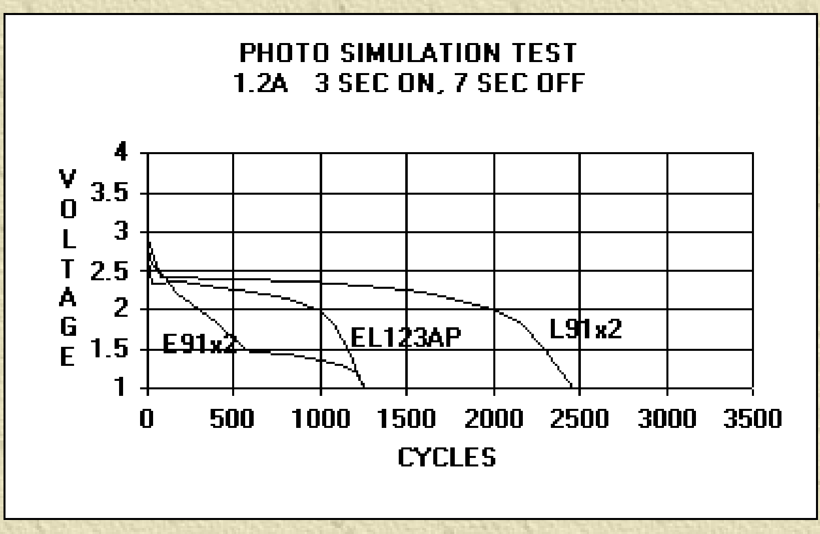
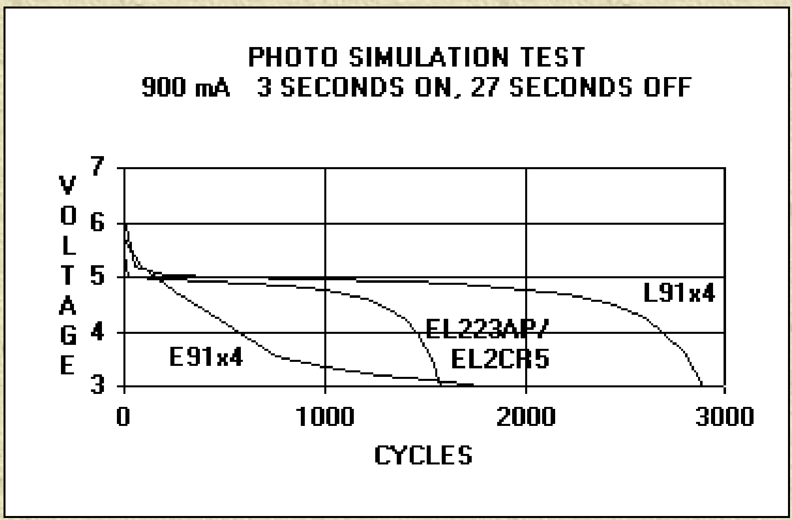
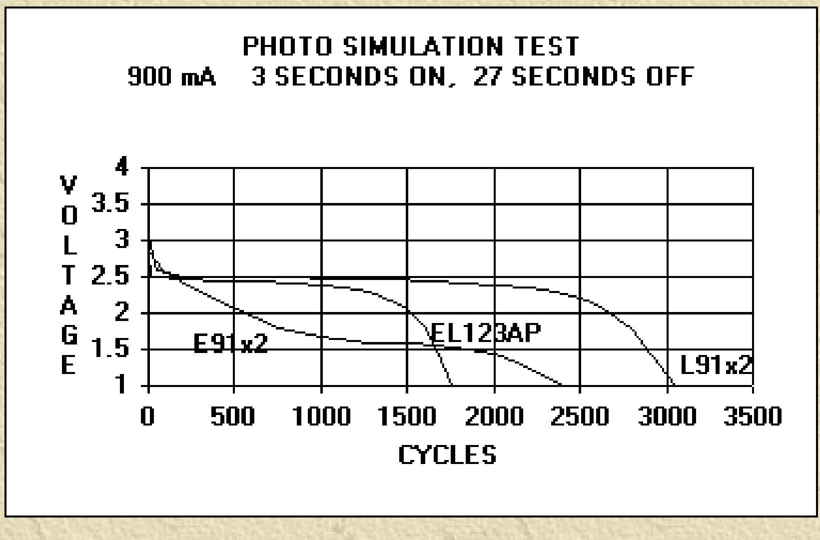


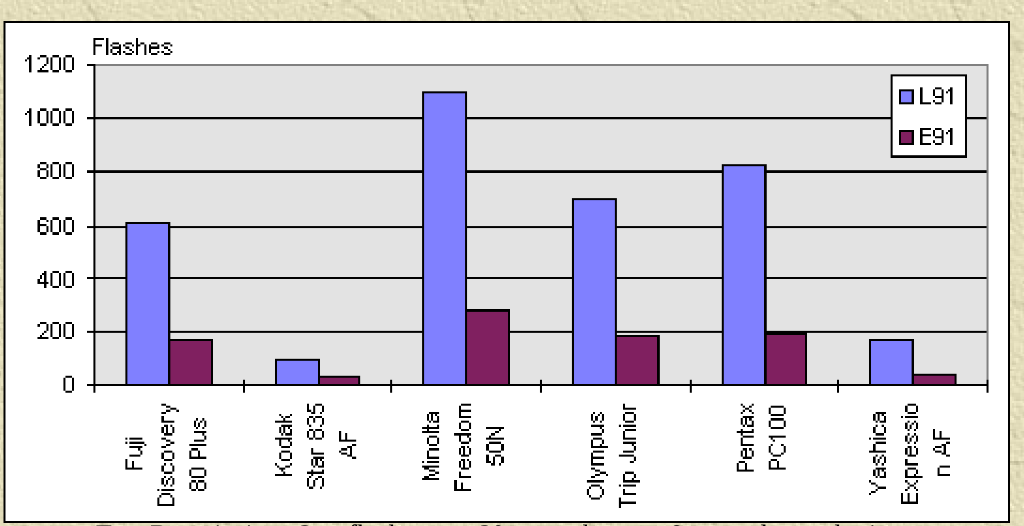
Photo Simulation Test

4 x AA vs. 3 Volt Lithium Photo Battery (EL123AP)



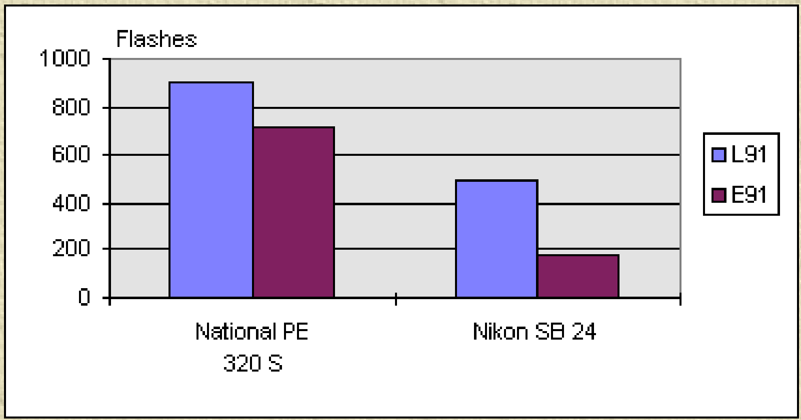


Lens Shutter Cameras



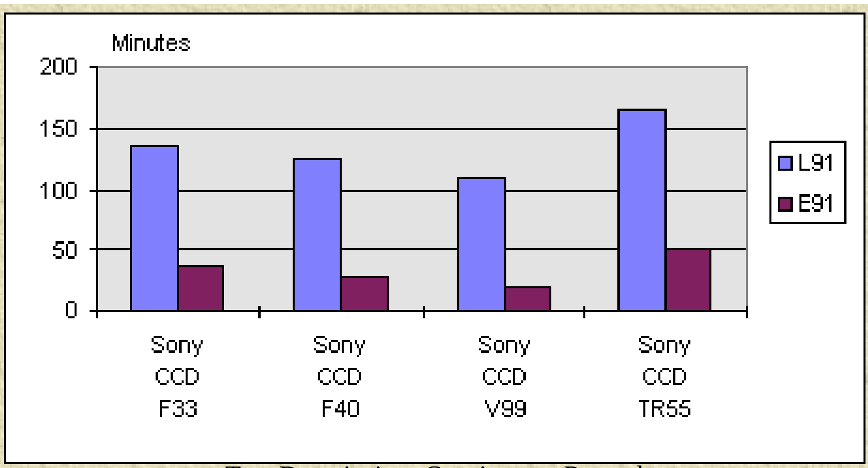
Test Description: One flash every 30 seconds to an 8 second recycle time.

Flash Attachments



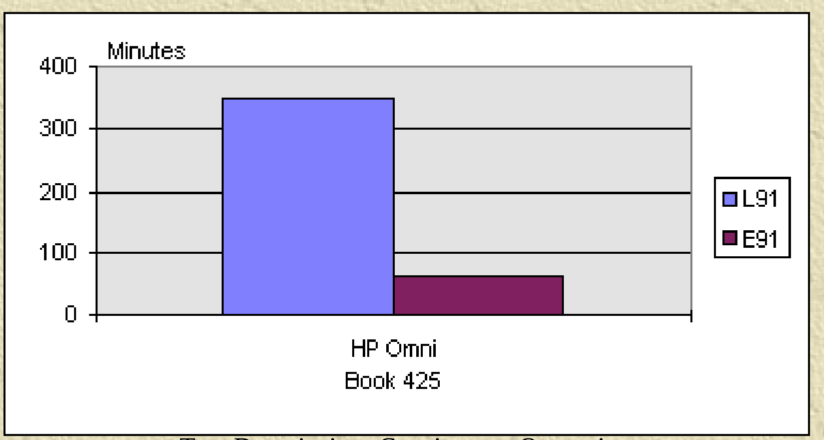
Test Description: One flash every 30 seconds to an 8 second recycle time.

Camcorder



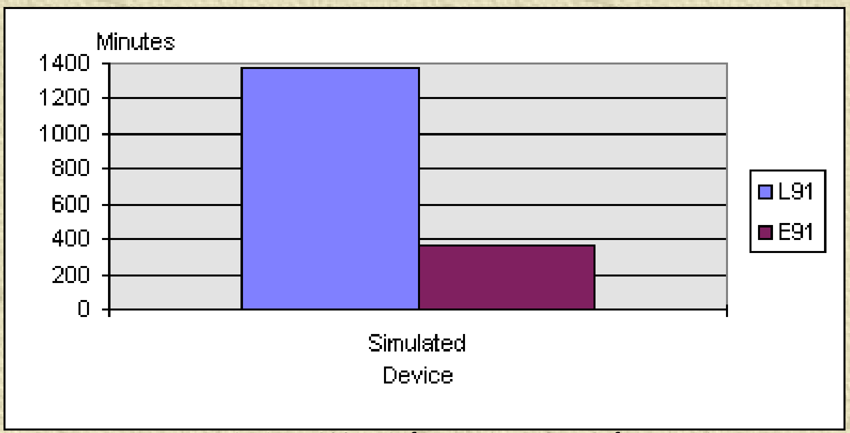
Test Description: Continuous Record

Portable Computer



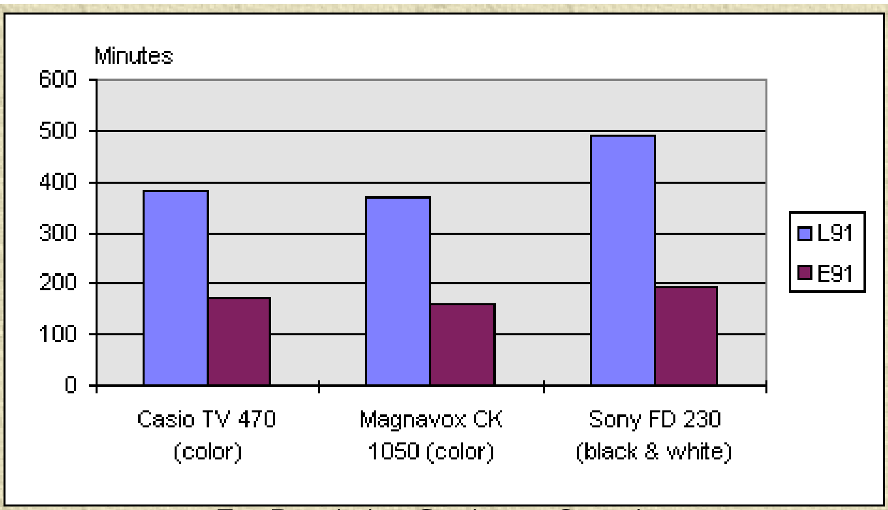
Test Description: Continuous Operation

Cellular Telephone



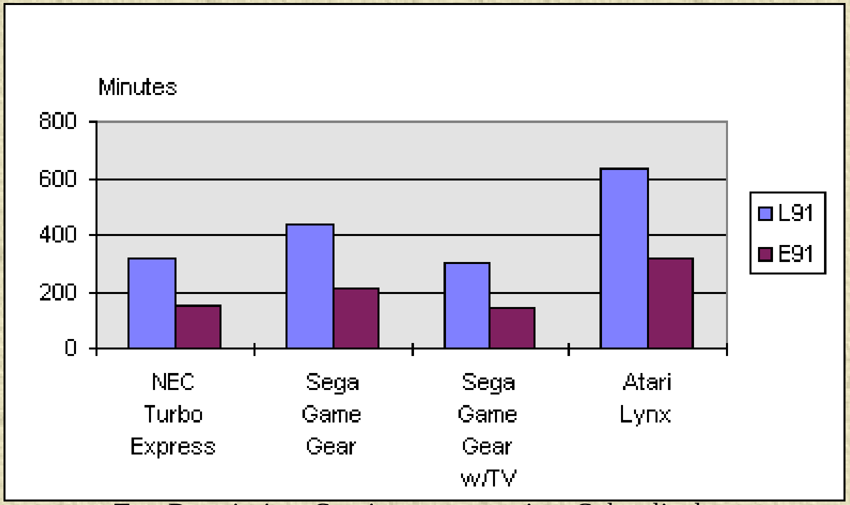
Test Description: 600 mA for 5 min., 43 mA for 55 min.
Repeat to 1.04 volts / cell

Televisions



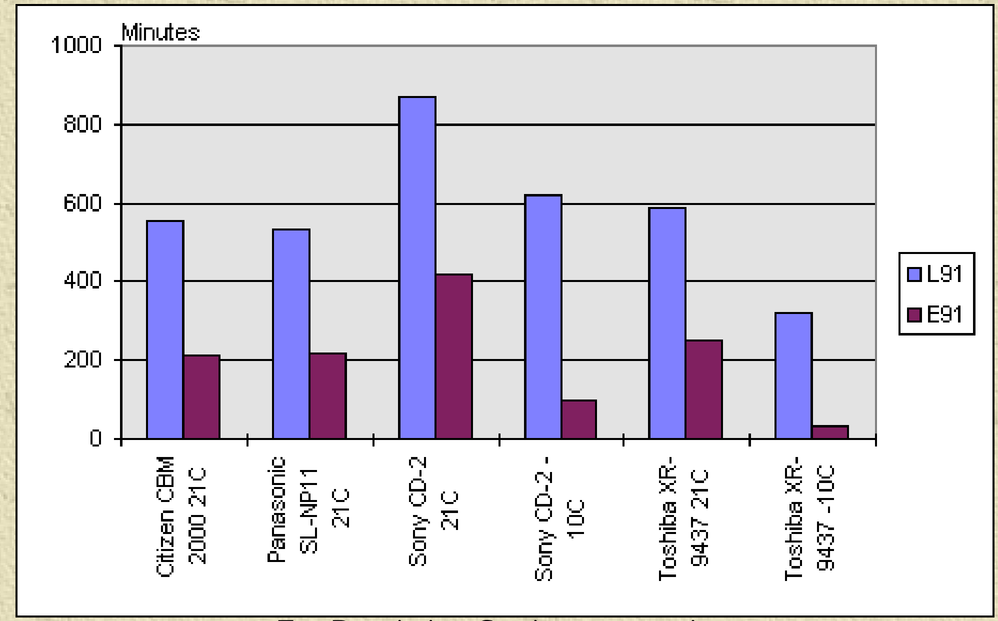
Test Description: Continuous Operation

Portable Video Games



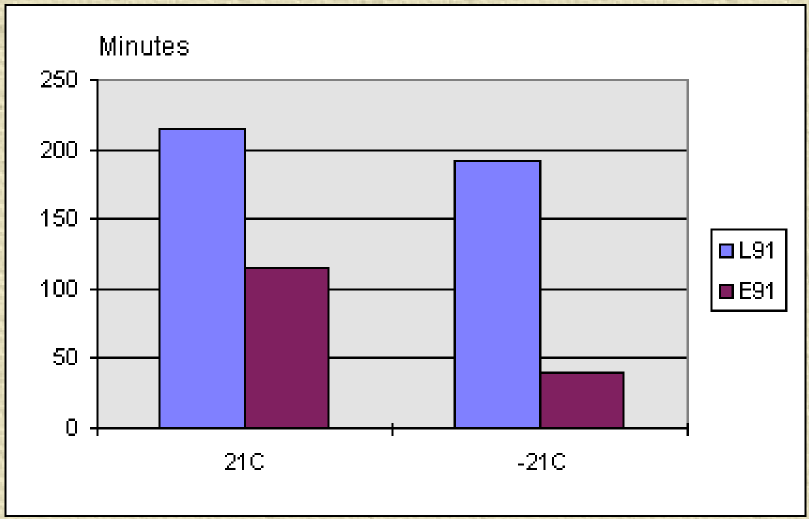
Test Description: Continuous operation. Color display.

Compact Disc Players



Test Description: Continuous operation.

Lights



Test Description: Continuous operation

L91 Technical Information

(Back to Top)

Safety Devices

Each L91 battery contains two safety devices, which are progressive as temperature increases.

Thermal Switch (PTC) - Limits the current when the temperature reaches 85 - 95° C. On very high rates of discharge in devices where internal cell heat is not allowed to dissipate, the PTC will temporarily increase in resistance to reduce the flow of current. After cooling, it will automatically revert back to normal condition.

Pressure Relief Vent - Operates at 120 - 130° C.

Storage

L91 batteries can be stored satisfactorily at room temperature and are stable at high temperatures. The maximum storage and operating temperatures are limited by jacket shrinkage. There are no problems at 60° C (140° F), and the batteries can tolerate 71° C (160° F) for at least 1 week.

Containment

Avoid potting or encapsulation as this obstructs the pressure relief vent. This vent is required to prevent excessive pressure buildup if the battery is exposed to very high temperatures.

Charging

The L91 battery is a primary battery and NOT designed to be recharged.

Connections

Use the same battery pressure contacts you would use for alkaline cells. Solder connections are not recommended, and if welded connections are needed, they should be made to the nickel-plated positive cap and the nickel-plated cell bottom using a capacitor discharge welder (normal alkaline cell welding procedures).

Safety Warning

Fire, explosion, burn hazard. Do not open battery, dispose of in fire, heat above 100° C (212° F), expose contents to water, recharge, put in backwards, mix with used or other battery types - may explode or leak and cause personal injury.

Disposal

For small quantities, use the same procedures used for other Eveready and Energizer consumer products

Thermal switch characteristics and considerations

The L91 battery contains a resettable thermal switch called a Positive Temperature Coefficient (PTC) device. This switch protects the battery from overheating if externally short circuited, charged or forced into deep discharge. This device is not a true switch since it does not have a completely off condition. Rather, it is a current limiter. When the PTC reaches the activation temperature, its resistance increases very rapidly. This reduces the flow of current, allowing the battery to cool. When the PTC cools to below the activation temperature, its resistance drops to a normal level. The PTC will continue to cycle from a low resistance state to a high resistance state for many cycles if the abusive condition continues or the battery is later exposed to other such conditions. Eventually the PTC may stop changing in resistance as its temperature changes, but if this does happen it will remain in a high resistance, safe condition.

There are two factors, which determine if or when the PTC will activate. One is the ambient temperature and the other is the internal heating that occurs as the result of discharge. The higher the rate of discharge (the heavier the drain or load on the battery), the more heat is generated. On light loads the heat dissipates and is not noticeable, but on heavy drains the battery may become noticeably warm to the touch (this is also true of alkaline batteries). If the load is too heavy, the PTC will heat up to the activation temperature. The higher the ambient temperature, the lower the load that the PTC will tolerate without activating.

All of the following can affect the ambient temperature or the internal heating during discharge:

- Surrounding air temperature
- Thermal insulating properties of the battery container
- Heat generated by equipment components
- Cumulative heating effects of many batteries
- Discharge rate(s) and duration(s)
- Frequency and length of rest periods

Because of the number of other variables involved, it is difficult to predict in advance whether the L91 battery can operate under certain load conditions. The maximum continuous current drain is established at 1.4 amps; however, higher pulses can be achieved. The most reliable method to determine this is to test the batteries in the device of interest under normal worst case conditions.

While the PTC does impose some limitations on applications for which the L91 battery is suitable, it is a critical element in ensuring that the battery is safe, protecting the battery, the equipment and the user.

Transportation (Revised November 6, 2001) (Back to Top)

Code of Federal Regulations - 49 CFR 173.185
Lithium Batteries and Cells
For most current version, CLICK HERE

General Informtaion

I. Energizer L91 lithium batteries meet the following requirements of the US transportation regulations {49 CFR 173.185- October 1, 2000}, the corresponding requirements of Special Provision A45 of the international air transportation regulations (IATA Dangerous Goods Regulations) and the corresponding requirements of Page 9033 of the international maritime regulations (International Maritime Organization IMDG Code):

   A. Each cell has a solid cathode and contains no more than 1 gram of lithium. {49 CFR 173.185(b)(1)}

   B. Each battery consists of one cell and contains no more than 2 grams of lithium. {49 CFR 173.185(b)(2)}

   C. Each cell is hermetically sealed. {49 CFR 173.185(b)(3)}

   D. The battery jacket provides effective insulation to prevent external short circuits during normal transportation. {49 CFR 173.185(e)(3)}

   E. Each battery contains no more than 1 gram of lithium. {49 CFR 173.185(b)(5)}

   L91 batteries, including those installed in electronic devices, are therefore expected from all other requirements to be transported as hazardous material if they are packed in strong packagings (except when installed in electronic devices).

II. If a battery contains more than two L91 cells permanently connected together (e.g., welded), it constitutes a new type of battery with respect to transportation regulations. Batteries containing no more than two L91 cells are also expected from all other requirements to be transported as hazardous material as described above. Batteries containing more than two L91 cells must pass certain testing requirements, as referenced in the regulations, before they may be transported. It is strongly recommended that persons interested in transporting batteries containing more than two L91 cells consult the applicable regulations.

I. It may also be necessary to consult regulations of the countries of origin and destination and any countries traversed in transportation.

IV. When transported for disposal to a permitted storage facility or disposal site, L91 cells are considered non-dangerous in transportation within the US if they meet the conditions set forth in I above.

V. Advice is available from your Energizer representative, but

WHEN YOU OFFER REGULATED MATERIALS FOR TRANSPORTAITON, COMPLIANCE WITH APPLICABLE TRANSPORTATION REQUIREMENTS IS YOUR RESPONSIBILTIY.

49 CFR 173.185

October 1, 2000 Revision

66 Section 173.185 is revised to read as follows:

ξ 173.185 Lithium cells and batteries

a. Except as otherwise provided in this subpart, a lithium cell or battery is authorized for transportation only if it conforms to the provisions of this section.

b. *Exceptions.* Cells and batteries are not subject to the requirements of this subchapter if they meet the following requirements:

1. Each cell with a liquid cathode may contain no more than 0.5 g (0.02 ounce) of lithium or lithium alloy, and each cell with a solid cathode may contain no more than 1.0 g (0.04 ounce) lithium or lithium alloy.
2. Each battery with a liquid cathode may contain an aggregate quantity of no more than 1.0g (0.04 ounce) lithium or lithium alloy, and each battery with a solid cathode may contain an aggregate quantity of no more than 2.0 g (007 ounce) of lithium or lithium alloy.
3. Each cell must be hermetically sealed.
4. Cells and batteries must be separated so as to prevent short circuits and must be packed in strong packagings, except when installed in equipment; and
5. If a liquid cathode battery contains more than 0.5 g (0.02 ounce) of lithium or lithium alloy or a solid cathode battery contains more than 1.0 g (0.04 ounce) lithium or lithium alloy, it may not contain a liquid or gas, if free, would be completely absorbed or neutralized by other materials in the battery.

(c) Cells and batteries also are not subject to this subchapter if they meet the following requirements:

1. Each cell contains not more than 5 g (0.18 ounces) of lithium or lithium alloy.
2. Each battery contains not more than 25 g (0.88 ounces) of lithium or lithium alloy.
3. Each cell or battery is of the type proven to be non-dangerous by testing in accordance with tests in part IV of the UN Recommendations on the Transport of Dangerous Goods, Tests and Criteria, such testing must be carried out on each type prior to the initial transport of that type; and
4. Cells and batteries and equipment containing cells and batteries which were first transported prior to January 1, 1995, and were assigned to Class 9 on the basis of the requirements of this subchapter in effect on October 1, 1993, may continue to be transported in accordance with the applicable requirements in effect on October 1, 1993.

d. Cells and batteries and equipment containing cells and batteries which were first transported prior to January 1, 1995, and were assigned to Class 9 on the basis of the requirements of this subchapter in effect on October 1, 1993, may continue to be transported in accordance with the applicable requirements in effect on October 1, 1993.

a. Cells and batteries may be transported as items of Class 9 if they meet the requirements in paragraphs (e)(1) through (e)(9) of this section:

1. Cells must not contain more than 12 g (0.42 ounces) of lithium or lithium alloy. When transported by passenger aircraft cells must not contain more than 3 g (0.11 ounces) of lithium or lithium alloy.
2. Batteries must not contain more than 500 g (17.6 ounces) of lithium or lithium alloy. When transported by passenger aircraft, batteries must not contain more than 125 g (4.4 ounces) of lithium or lithium alloy.
3. Each cell and battery must be equipped with an effective means of preventing external short circuits.
4. Each cell and battery must incorporate a safety-venting device or be designed in a manner that will preclude a violent rupture under conditions normally incident to transportation.
5. Batteries containing cells or series of cells connected in parallel must be equipped with diodes to prevent reverse current flow.
6. Cells and batteries must be packed in strong inner packagings not more than 500 g (17.6 ounces) of lithium or lithium alloy. When transported by passenger aircraft, inner packaging must not contain more than 125 g (4.4 ounces) of lithium or lithium alloy.
7. Cells and batteries must be packed in inner packaging in such a manner as to effectively prevent short circuits and to prevent movement which could lead to short circuits.
8. Cells and batteries must be packaged in packaging conforming to the requirements of part 178 of this subchapter at the Packing Group II performance level:
    i. Inner packaging must be packed within a wooden box (4CI, 4C2, 4D, or 4F), fiberboard box (4G), fiber drum (1G), or metal drum (1A2 or 1B2).
    ii. Cells and batteries intended for air transportation must be packaged in metal drums (1A2 or 1B2) fitted with gas-tight gaskets;

and

iii. When the outer packaging is metal, the inner packaging must be separated from each other and from the outer packaging by at least 25 mm (1 inch) of non-combustible cushioning material.

9. One of the following criteria must be met:

   i. Each cell or battery is of the type proven to meet the criteria of Class 9 by testing in accordance with tests in part IV of the UN Recommendations on the transport of Dangerous Goods, tests and Criteria;

   ii. Ten cells and one battery of each type taken from production each week should be subjected to extreme temperature exposure and the short circuit test procedures I part IV of the UN Recommendations on the transport of Dangerous Goods, Tests and Criteria, or equivalent tests approved by the Associate Administrator for hazardous Materials Safety. There should be no evidence of distortion, leakage or internal heating in conducting the extreme temperature exposure test procedure. In conducting the short circuit test procedure, if venting occurs, an open flame applied to venting fumes should not produce an explosive condition; or

   iii. Cells and batteries that are hermetically sealed are exempt from paragraphs (e)(8)(ii) and (e)(8)(iii) of this section if the cells and batteries are subjected to the altitude simulation, extreme temperature exposure, vibration, and shock test described in the UN recommendations in the Transport of Dangerous Goods. Tests and Criteria, or equivalent tests approved by the Associate Administrator for hazardous Materials Safety, and show no visible evidence of out-gassing, leakage, loss of mass or distortion.

10. Except as provided in paragraph (I) of this section, cells or batteries may not be offered for transportation or transported if any cell has been discharged to the extent that the open circuit voltage is less than two volts or is less than 2/3 of the voltage of the fully charged cell, whichever is less.

f. Equipment containing or packed with cells and batteries meeting the requirements of paragraph (b) or (c) of this section is expected from all other requirements of this subchapter.

a. Equipment containing or packed with cells and batteries may be transported as items of Class 9 if the batteries and cells meet all the requirements of paragraph (e)(9) of this section and are packed as follows:

1. Equipment containing cells and batteries must be packed in a strong out packaging that is waterproof or is made waterproof through the use of a liner. The equipment must be secured within the outer packaging and be packed as to effectively prevent movement, short circuits, and accidental operation during transport; and

2. Cells and batteries packed with equipment must be packed in inner packagings conforming to paragraph (e)(8) of this section in such a manner as to effectively prevent movement and short circuits. Not more than 5 kg of cells and batteries may be packed with each item of equipment.

h. Cells and batteries, for disposal, may be offered for transportation or transported to a permitted storage facility and disposal site by motor vehicle when they meet the following requirements:

1. Cells must not contain more than 12 g (0.42 ounce) and batteries must not contain more than 500 g (17.6 ounces) of lithium or lithium alloy;

2. Be equipped with an effective means of preventing external short circuits; and

3. Be packed in a strong outer packaging conforming to the requirements of ξ 173.24 and 173.24a. The packaging need not conform to performance requirements of part 178 of this subchapter.

i. Cells and batteries and equipment containing or packed with cells and batteries which do not comply with the provisions of this section may be transported only if they are approved by the Associate Administrator for Hazardous Materials Safety.

ii. For testing purposes, cells containing not more than 12 g (0.42 ounce) of lithium or lithium alloy and batteries containing not more than 500 g (17.6 ounces) of lithium or lithium alloy may be offered for transportation or transported by highway only as items of Class 9. Packaging must conform to paragraphs (e)(8)(I) and (iii) of this section with not more than 100 cells per package.

Back to Top of Page

Back to Index Printer Friendly Version

Energizer 9V Lithium Batteries

Performance

- The Energizer 9-volt LITHIUM (L522) outlasts premium alkaline batteries substantially over a wide range of applications.

Discharge Rate

- The L522 provides a flat voltage discharge profile over a wide range of discharge conditions.

Long Shelf Life

- Storage life of up to 10 years in our foil pouch.

Cost Effective

- The Energizer 9-volt LITHIUM battery significantly reduces battery replacement due to its ability to operate longer and its long shelf life.

Environmentally Benign

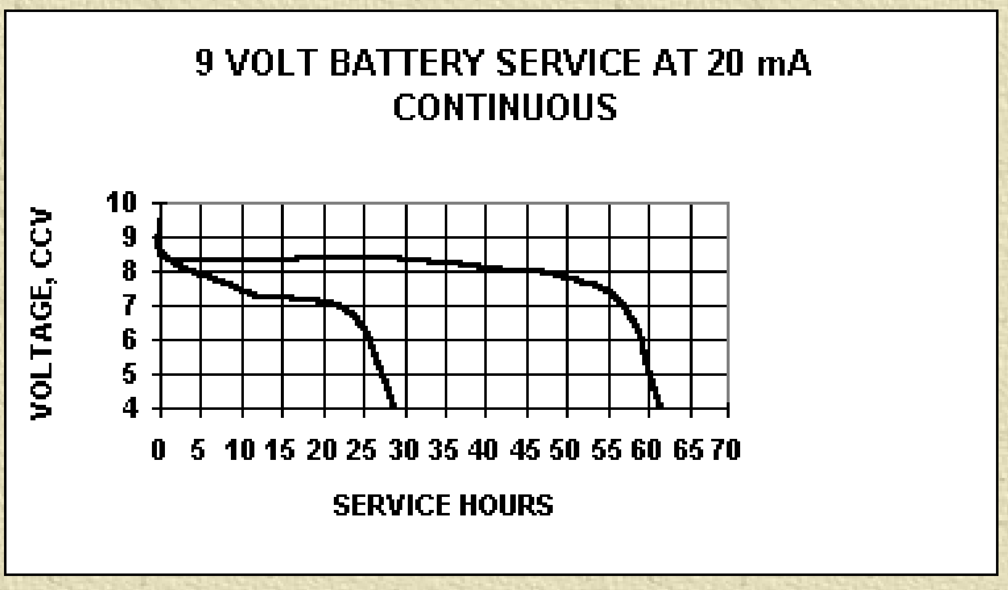
- The L522 is classified as Non-Hazardous Solid Waste and does not require any special method of disposal.

Exceptional Temperature Range Performance

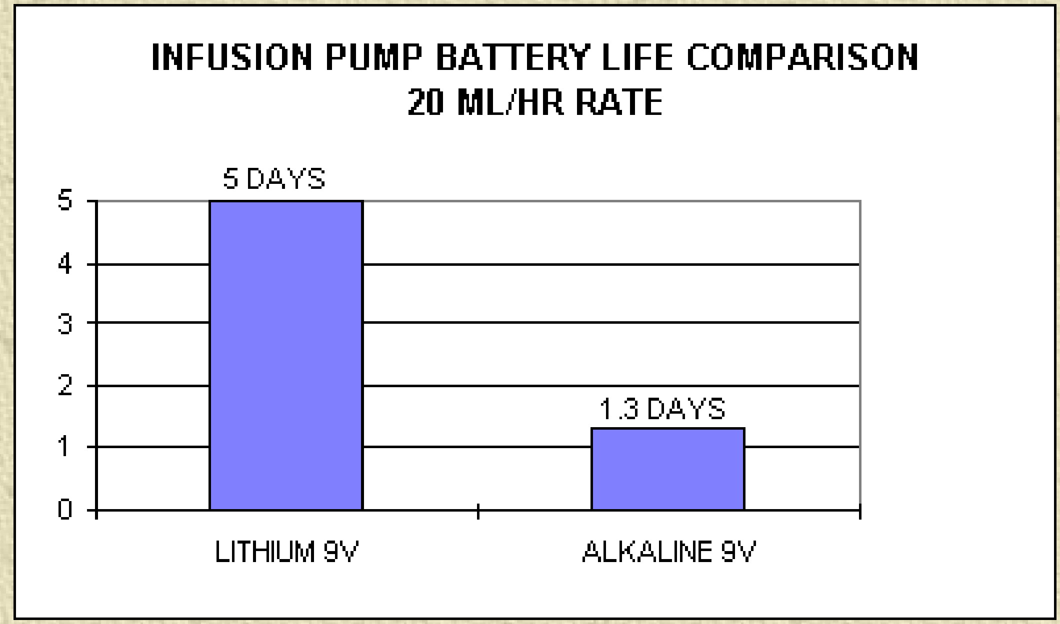
- The L522 operates from -40C to +60C.

Energizer Lithium Batteries are the reliable power source for critical applications offering more than twice the energy of alkaline batteries.

- Continuous Performance - The L522 at 1200mAh has twice the capacity of alkaline batteries.
- Extended storage life - up to 10 years in foil pouch.
- Reliable under adverse conditions-operates in wide range of temperatures -40C to +60C.
- Requires no special method of disposal-contains no added Lead, Cadmium, or Mercury.
- Cost Effective-less frequent battery replacement reduces overall cost in many portable devices.
- Lightweight-the L522 is 33% lighter than alkaline.
- The L522 is suitable for many devices that use alkaline batteries. For medical devices, contact the device manufacturer for battery specifications.



The Lithium discharge curve is longer and flatter than Alkaline, providing a consistently higher voltage throughout the life of the battery. As the chart demonstrates, Lithium offers longer and more effective service.



Superior Performance in a wide range of high-tech devices.

Medical Equipment:

- Ambulatory Infusion Pumps
- Holter Monitors
- Digital Thermometers
- Galvanic Stimulators
- Blood Analyzers
- TENS Units
- Pulse Oximeters
- Telemetry Systems

Electronic Instruments:

- Remote control transmitter
- Wireless microphone
- Photometer
- Radar detector
- Digital scale

Security/Law Enforcement:

- Wireless alarm system
- Transmitter
- Receiver
- Electronic Lock

For technical and environmental information or for an Energizer distributor near you, call 1-800-426-8268.

Back to Top of Page

Back to Index Printer Friendly Version

Energizer Manganese Dioxide (Zn/MnO_2) Batteries

Table of Contents

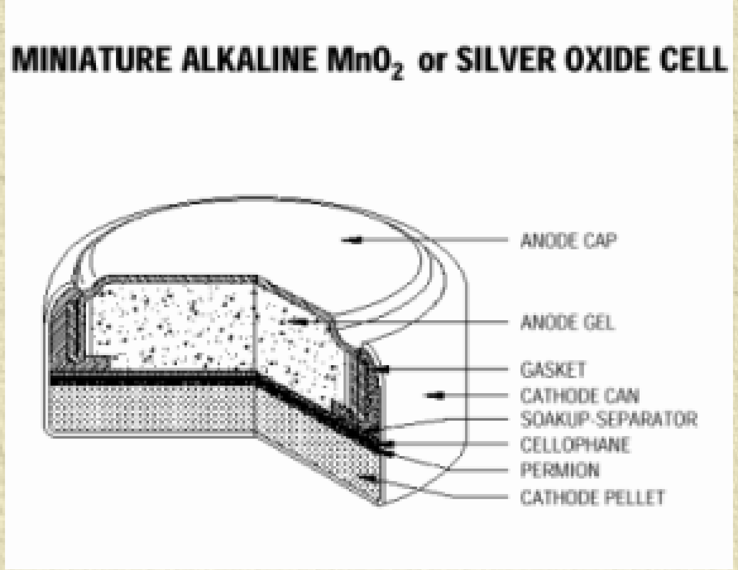
System Description:

The miniature manganese dioxide primary battery is designed to provide an economical power source for device applications that do not require the flat voltage discharge curve characteristic of mercuric and silver oxide batteries. Device applications in which miniature manganese dioxide batteries can be used as substitutes include: calculators, automatic exposure control cameras, some watches and a variety of small toys. The substitution of miniature manganese dioxide batteries for comparable mercuric or silver oxide batteries should only be made where recommended by the device manufacturer. General characteristics of the miniature manganese dioxide systems are:

- Rate sensitivity comparable to silver oxide.
- Good low temperature characteristics.
- Good resistance to shock, vibration, and acceleration.
- Excellent service maintenance; in excess of 90% after storage at 21°C(70°F) for five years.
- Low and essentially constant internal resistance.
- Lower energy density than comparable mercuric or silver oxide batteries.
- Sloping discharge curve.
- Slight bulge on completion discharge.
- Available in voltages ranging from 1.5 to 12.0 volts, in a variety of sizes.

Battery Construction:

Miniature manganese dioxide batteries are produced with flat circular cathodes and homogeneous gelled anodes. A cutaway of miniature manganese dioxide battery is illustrated in the following diagram:

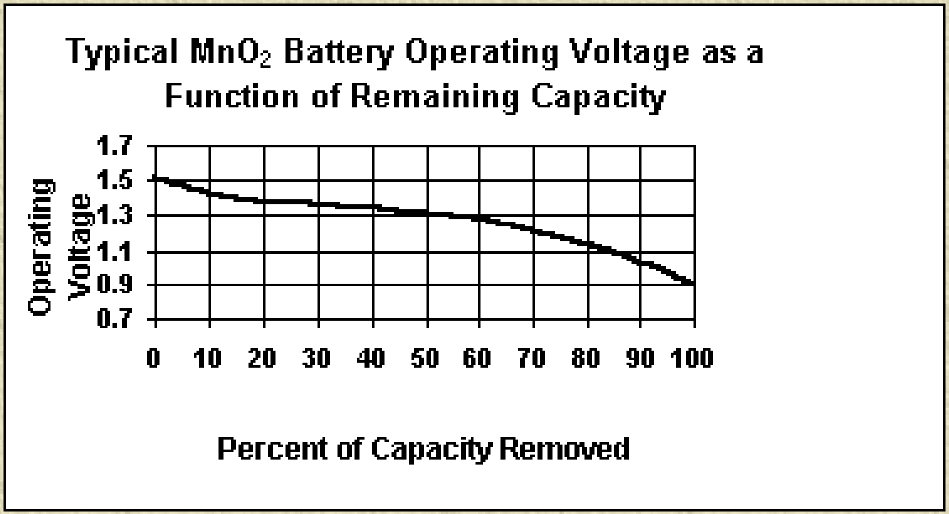


Click here for Cross Section (Adobe .pdf File)

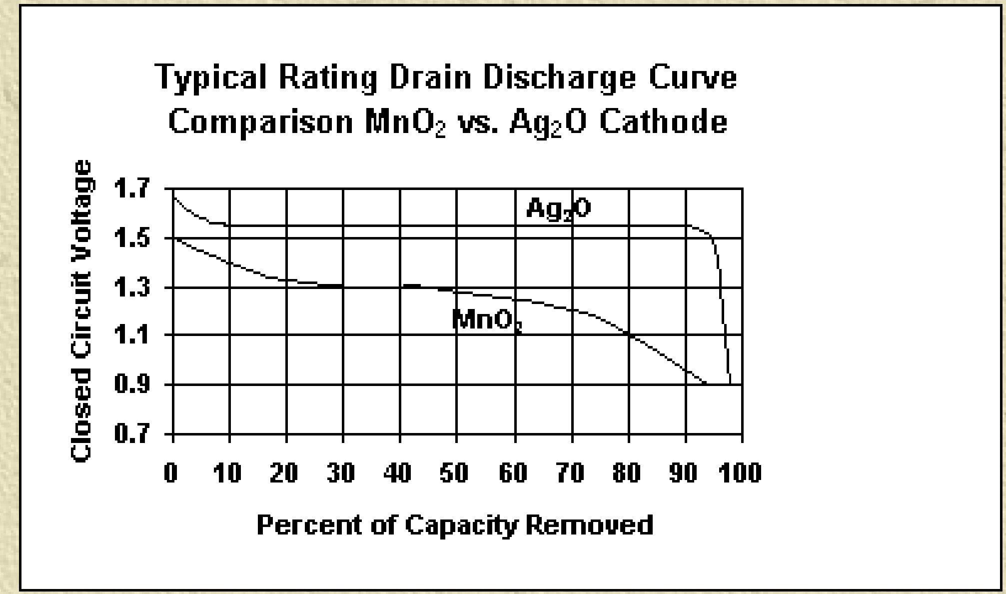
Cathodes are a mixture of MnO_2 and conductor.
Anodes are a gelled mixture of amalgamated zinc powder and electrolyte.
Separators of specially selected materials prevent migration of any solid particles in the battery.
Insulating and sealing gaskets are molded of nylon.
Exterior battery surfaces of nickel are used to resist corrosion and to insure good electrical contact.

Electro-Chemistry:

Miniature manganese dioxide batteries consist of a manganese dioxide cathode, a zinc anode of high surface area, and a highly alkaline electrolyte consisting of potassium hydroxide. The open circuit voltage of miniature manganese dioxide batteries is approximately 1.6 volts. The operating voltage at typical current drains varies with the depth of discharge of the battery as shown in the following diagram:



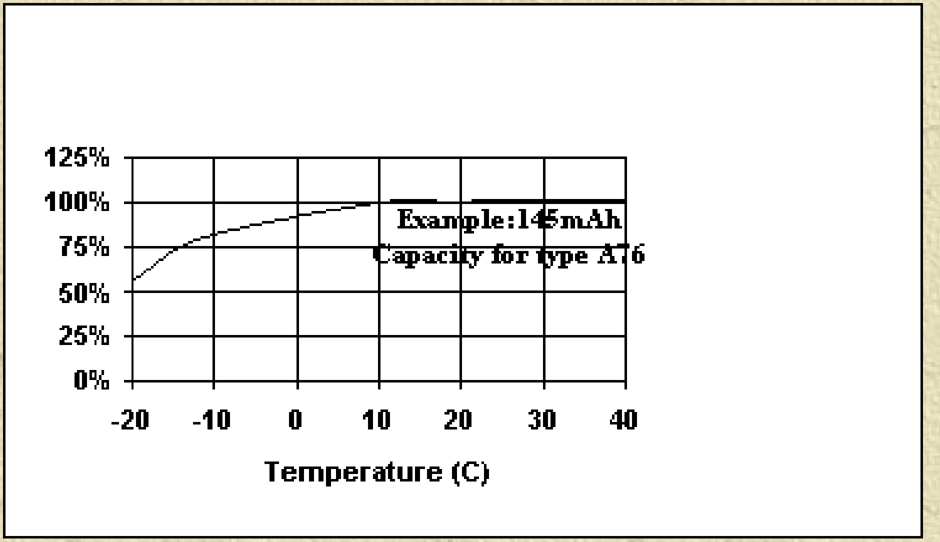
A comparison of manganese dioxide (MnO_2) service versus silver oxide (Ag_2O) is as follows:

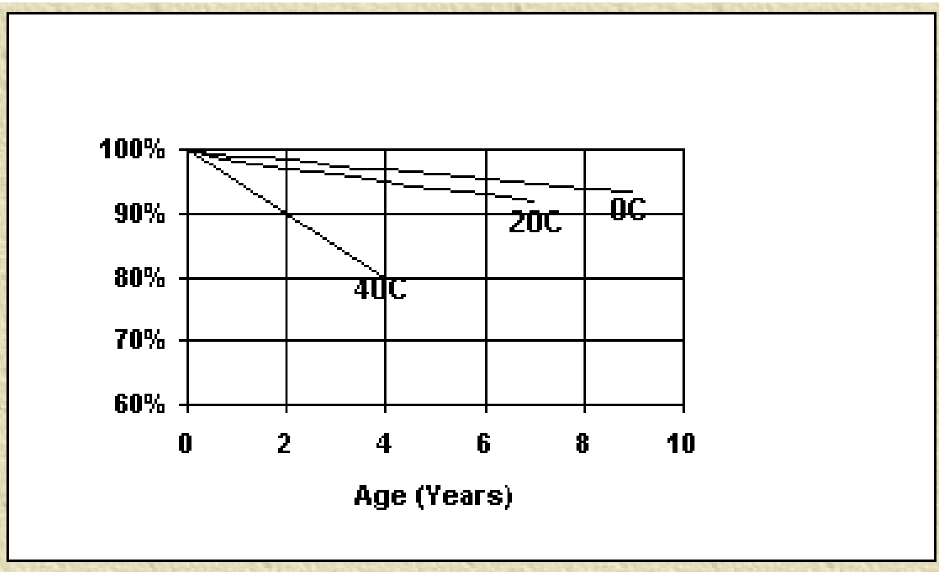


Miniature manganese dioxide batteries typically exhibit an expansion of the cathode on discharge which results in an overall increase in the battery's height. This increase in height is referred to as bulge. While miniature manganese dioxide batteries are designed to minimize bulging, they will typically bulge to a height greater than comparable silver oxide batteries during discharge. Specific bulge data is given on the following individual battery data pages.

Temperature:

Typical temperature effects on miniature dioxide batteries are shown in the following graphs:





Applications:

Manufacturers who plan to recommend the use of miniature manganese dioxide batteries in their devices must accommodate their unique discharge curve shape in the design of their equipment.

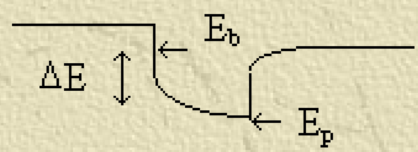
Internal Resistance:

The internal resistance (R_j) of a battery is its opposition to the flow of current. In all cases, this resistance increases as the temperature of a battery decreases.

Internal resistance is typically measured as a reduction in closed circuit voltage when a load is applied (voltage drop).

The R_j values obtained are subject to a number of variables and operator techniques. The effective R_j values shown on the following individual data pages were calculated using the voltage drop method which projects the batteries' current carrying capability in actual device applications. This calculation involves placing a battery on a constant background load, allowing it to stabilize, and then pulsing it with a heavier load for one second. The resulting voltage drop is then measured and expressed in terms of ohms as shown in the following example:

R_j = Internal Resistance



R_b = Resistance of Background Load

E_b = Background Voltage

R_p = Resistance of Pulse Load

E_p = Voltage at End of Pulse

ΔE = Voltage Change

ΔI = Current Change

I_b = Background Current

I_p = Current at End of Pulse

$$I_b = \frac{E_b}{R_b}$$

$$I_p = \frac{E_p}{R_p}$$

$$R_j = \frac{\Delta E}{\Delta I} = \frac{E_b - E_p}{I_p - I_b}$$

Back to Top of Page

Back to Index Printer Friendly Version

Energizer Silver Oxide (Zn/Ag_2O) Batteries

Table of Contents:

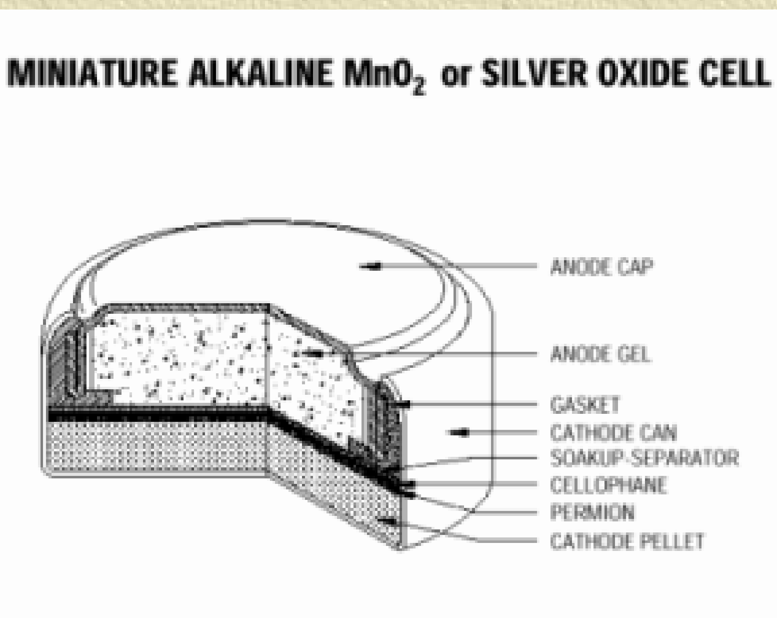
System Description:

The silver oxide/zinc alkaline primary battery is the predominate system of the miniature battery product line. It typically can be used in watches, calculators, photoelectric exposure devices, hearing aids, and electronic instruments. Its general characteristics include:

- Higher voltage than comparable mercury batteries
- Flatter discharge curve than alkaline manganese dioxide batteries
- Good low temperature characteristics
- Good resistance to shock, vibration, and acceleration
- Low and essentially constant internal resistance
- Excellent service maintenance; in excess of 90% after storage at 21°C(70°C) for five years
- Available in voltages ranging from 1.5 to 6.0 volts and a variety of sizes.

Battery Construction:

Silver oxide batteries are currently produced with flat circular cathodes and homogeneous gelled anodes. A cutaway of a silver oxide battery is illustrated in the following diagram:

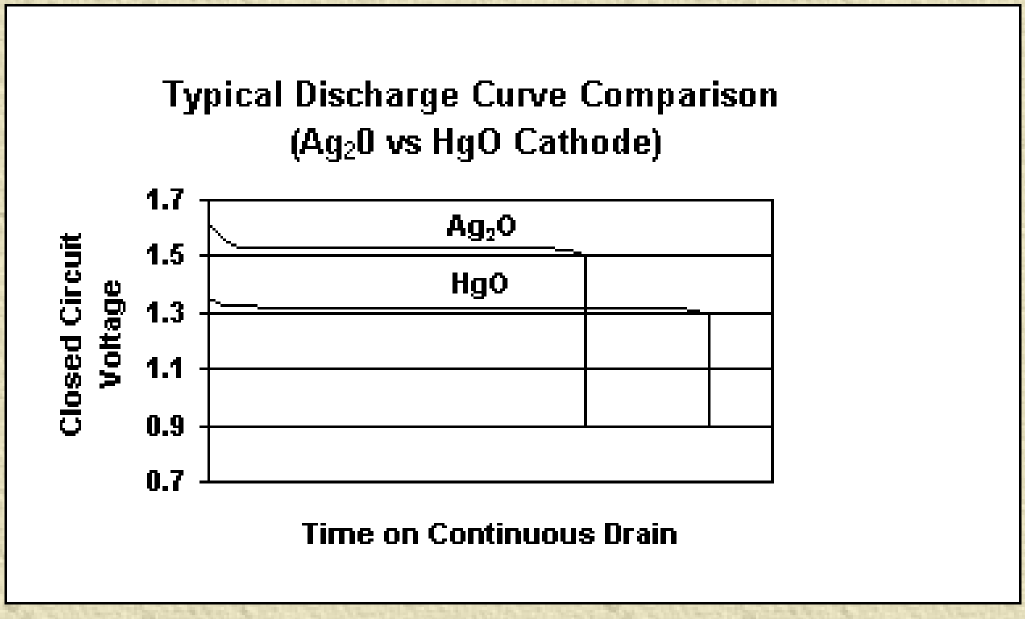


Click here for Cross Section
(Adobe .pdf File)

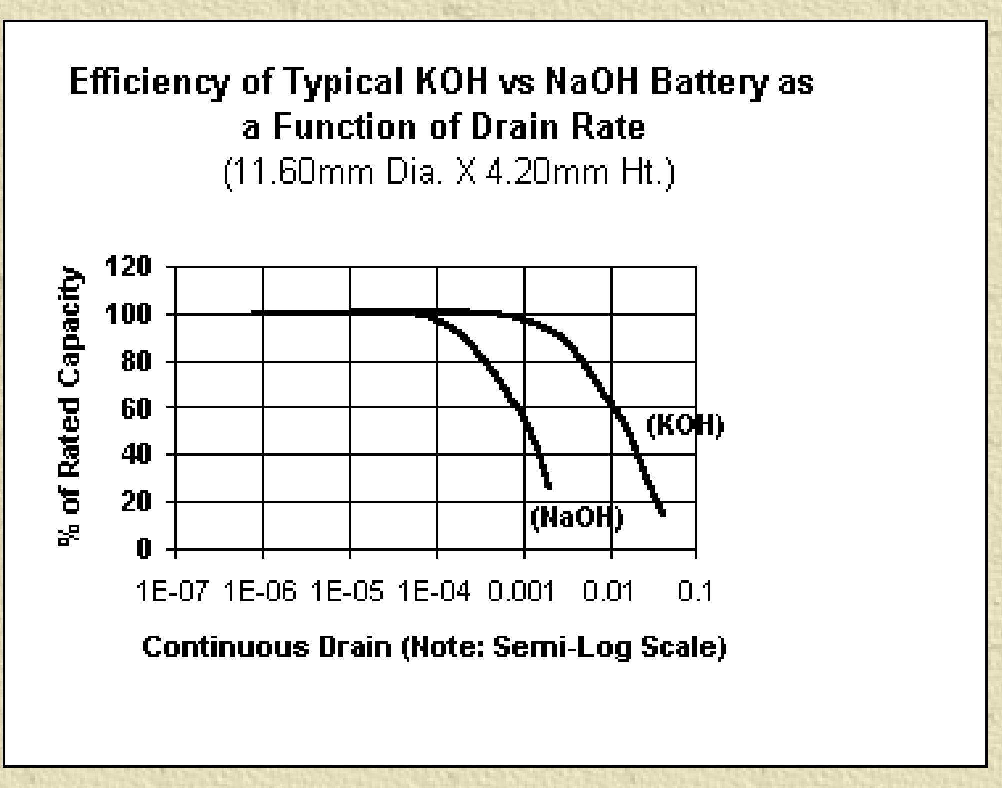
Cathodes are a mixture of Ag_2O and conductor.
Anodes are a gelled mixture of amalgamated zinc powder and electrolyte.
Separators of specially selected materials prevent migration of any solid particles in the battery.
Insulating and sealing gaskets are molded of nylon.
Exterior battery surfaces of nickel are used to resist corrosion and to insure good electrical contact.

Electro-Chemistry:

Silver oxide batteries contain a cathode of silver oxide with a low percentage of manganese dioxide and graphite, an anode of high surface area zinc, and a highly alkaline electrolyte consisting of either sodium hydroxide or potassium hydroxide. The open circuit voltage of silver oxide batteries is 1.6 volts. The operating voltage at typical current drains is 1.55 volts or more. Silver oxide batteries offer a higher flat operating voltage characteristic than mercuric oxide batteries as illustrated in the following diagram:



The type of electrolyte used with silver oxide batteries determines their rate or current carrying capability. Under heavy drains, potassium hydroxide (KOH) electrolyte offers less resistance to the current flow and allows the battery to operate at higher efficiency than a sodium hydroxide (NaOH) electrolyte. At low drains both electrolytes operate with equal efficiency. This relationship is shown in the following diagram:

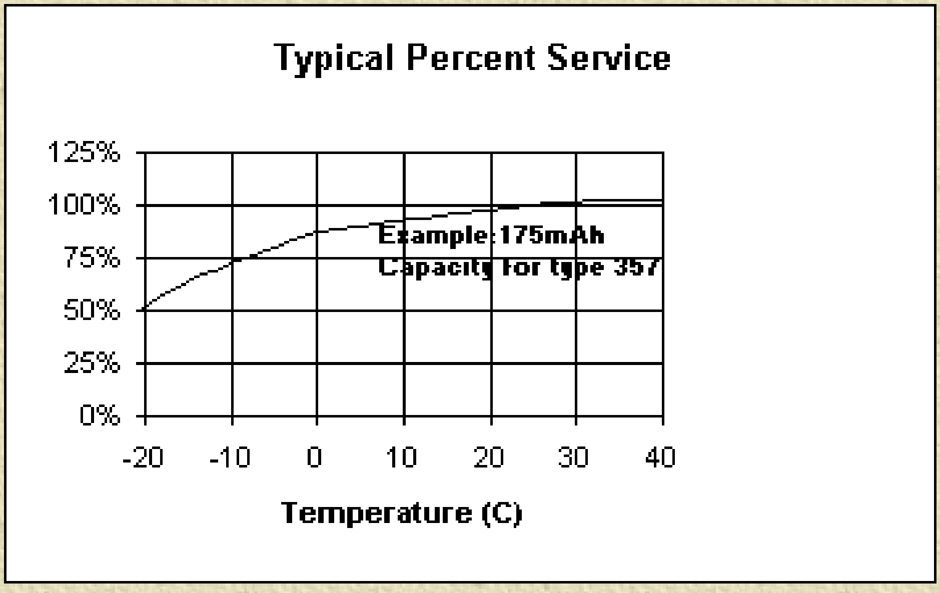


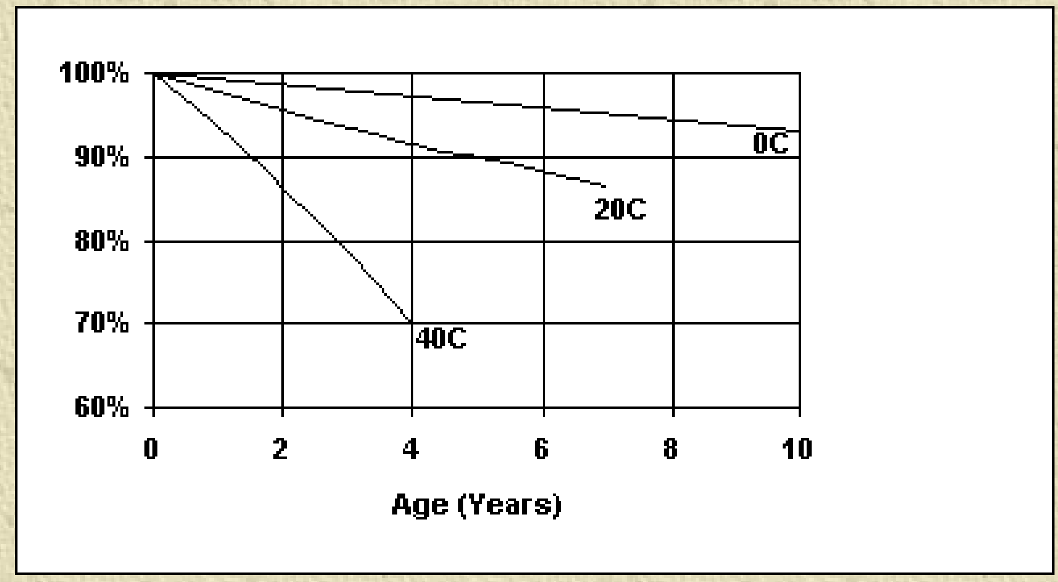
Silver oxide batteries containing a KOH electrolyte are more difficult to seal than those containing at NaOH electrolyte. As a result, NaOH batteries are typically more salt resistant than similar sized KOH batteries. Both batteries however, exhibit excellent long term salt resistance.

Temperature:

Silver oxide batteries have good performance characteristics at temperature extremes. They can be used up to 55°C(131°F). Silver oxide batteries utilizing KOH as an electrolyte will operate with less loss of efficiency at lower temperatures than comparable NaOH batteries. Batteries with KOH electrolyte will operate down to -28°C (-20°F) and NaOH batteries down to -10°C(14°F) with some service reduction in both types.

Typical temperature effects on miniature silver oxide batteries are shown in the following graphs:





Applications:

Eveready silver oxide batteries are specially designed to meet the varying power requirements of a wide variety of applications.

Watch and Calculator - Silver oxide watch batteries using a sodium hydroxide (NaOH) electrolyte system are primarily designed for low drain continuous use over long periods of time, typically up to five years. This is commonly found in analog watch applications.

Silver oxide watch batteries using a potassium hydroxide (KOH) electrolyte system are principally designed for continuous low drains with periodic high drain pulse demands for periods of approximately one to two years. This is typical of applications such as LCD watches with backlight, analog watches with alarms and calculators.

Hearing Aid and Electronic - Silver oxide hearing aid and electronic batteries are designed to produce greater volumetric energy density at higher continuous discharge rates than silver oxide watch or photographic batteries. Hearing aid and electronic batteries use potassium hydroxide electrolyte in combination with the separator system designed to match the required application.

Photographic - Silver oxide photo batteries are designed to provide constant voltage or periodic high drain pulses with or without a low drain background current.

Internal Resistance:

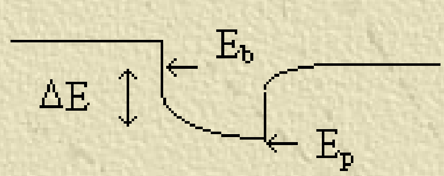
The internal resistance (R_j) of a battery is its opposition to the flow of current. In all cases, this resistance increases as the temperature of a battery decreases.

The internal resistance is typically measured as a reduction in closed circuit voltage when the applied load is increased. (voltage drop)

The R_j values obtained are subject to a number of variables and operator techniques. The effective R_j values shown on the individual data pages were calculated using the voltage drop method which projects the batteries' current carrying capability in actual device applications. This calculations involves placing a battery on a constant background load, allowing it to stabilize and then pulsing it with a heavier load for one second. The resulting voltage drop is then measured and expressed in terms of ohms as shown in the following example:

R_j = Internal Resistance

R_b = Resistance of Background Load
E_b = Background Voltage
R_p = Resistance of Pulse Load
E_p = Voltage at End of Pulse
ΔE = Voltage Change
ΔI = Current Change
I_b = Background Current
I_p = Current at End of Pulse



$$I_b = \frac{E_b}{R_b}$$

$$I_p = \frac{E_p}{R_p}$$

$$R_j = \frac{\Delta E}{\Delta I} = \frac{E_b - E_p}{I_p - I_b}$$

This reference manual contains general information on all Energizer/Eveready batteries within the Silver Oxide chemical system in production at the time of preparation of the manual. Since the characteristics of individual batteries are sometimes modified, persons and businesses that are considering the use of a particular battery should contact the nearest Energizer Sales Office for current information. None of the information in the manual constitutes a representation or warranty by Eveready Battery Company, Inc. concerning the specific performance or characteristics of any of the batteries or devices.

Back to Top of Page

Back to Index Printer Friendly Version

Energizer Zinc Air (Zn/O_2) Batteries

Table of Contents

System Description:

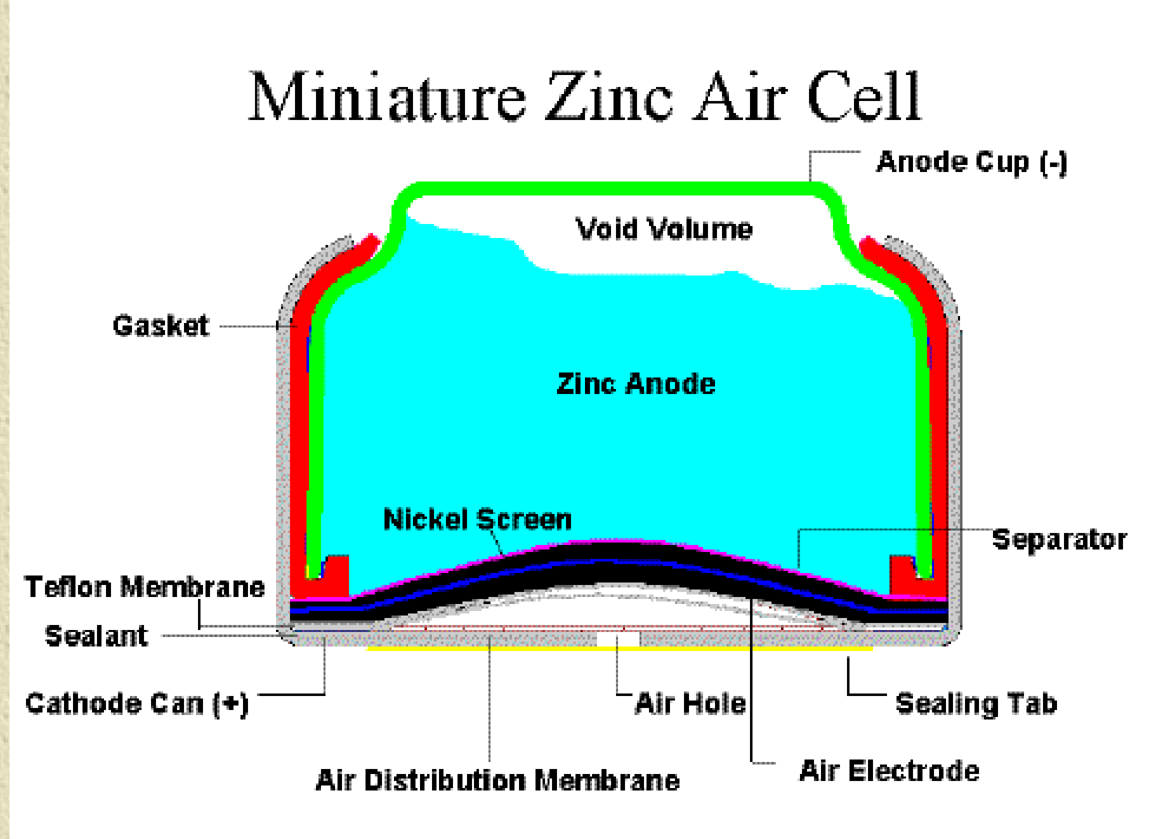
Miniature zinc air batteries are primarily designed to provide power to eyeglass, behind-the-ear, and in-the-ear miniature hearing aids. In most hearing aid applications, zinc air batteries can be directly substituted for silver oxide or mercuric oxide batteries and will typically give the longest hearing aid service of any common battery system.

The general characteristics are:

- Highest capacity-to-volume ratio for miniature batteries..
- Relatively flat discharge curve.
- More stable voltage at high currents than mercuric oxide or silver oxide miniature batteries.
- Essentially constant internal resistance.
- Activated by removing covering (adhesive backed tab) from air access hole.
- Most effective in applications that consume battery capacity in a few weeks.
- Must have access to air (oxygen) to operate.
- Nominal voltage of 1.4
- Excellent service maintenance prior to tab removal.
- Available in common hearing aid battery sizes.

Battery Construction:

The electrodes in "Air Cell" batteries are gelled zinc powder anodes and catalyzed carbon cathodes. A hole in the battery container allows oxygen from the air to enter the cathode and be reduced on the carbon surface. At the same time, the zinc in the anode is oxidized in the same way as in a miniature mercuric oxide or silver oxide battery. A cutaway of an "Air Cell" battery is illustrated in the following diagram:



Click here for Cross Section (Adobe .pdf File)

Cathodes are catalyzed carbon which reduce oxygen from the air.
Anodes are a gelled mixture of amalgamated zinc powder and electrolyte.
Electrolyte is a highly conductive solution of KOH in water.
Separators are materials specially selected to prevent migration of solid particles between the electrodes.
Insulating and sealing gaskets are molded nylon.
Exterior battery surfaces of nickel are used to resist corrosion and to insure good electrical contact.

Electro-Chemistry:

The electrode reactions for a zinc air battery are as follows

Anode: $Zn + 2OH \Leftrightarrow ZnO + H_2O + 2e$
Cathode: $O_2 + 2H_2O + 4e \Leftrightarrow 4OH$

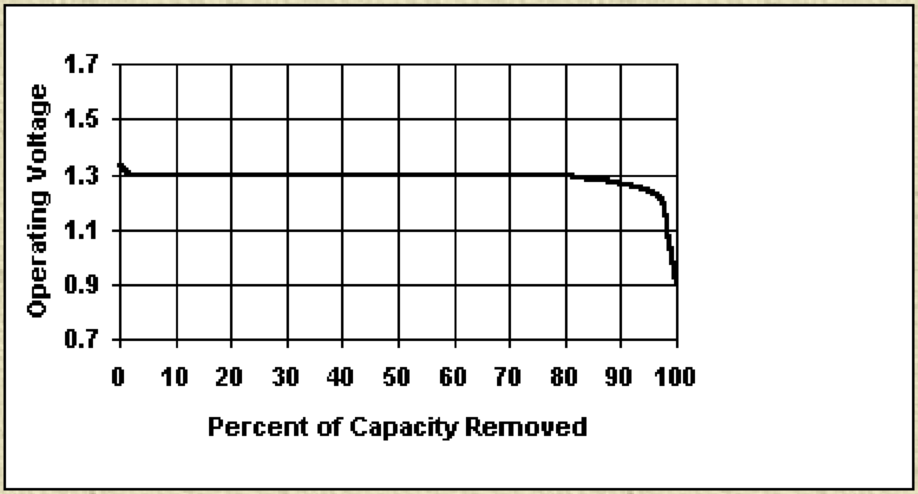
Overall: $2Zn + O_2 \Leftrightarrow 2ZnO$

While typical voltage resulting from this reaction is 1.4, it will vary with current drawn from the battery and with depth of discharge.

The air must have an unobstructed path through the device and into the cathode so that the oxygen in the air is available to discharge the cathode. A hole (or holes) is provided in the battery container to allow the necessary oxygen into the battery. Because excessive moisture transport can degrade battery performance, the container hole is sealed by an adhesive backed tab prior to consumer use. This tab must be removed when the battery is put into service.

The zinc air system provides the highest capacity to volume ratio of the various miniature battery systems. It has a relatively flat discharge curve and is less rate sensitive than mercuric oxide or silver oxide miniature batteries. "Air Cell" batteries have essentially constant internal resistance.

A typical discharge is:

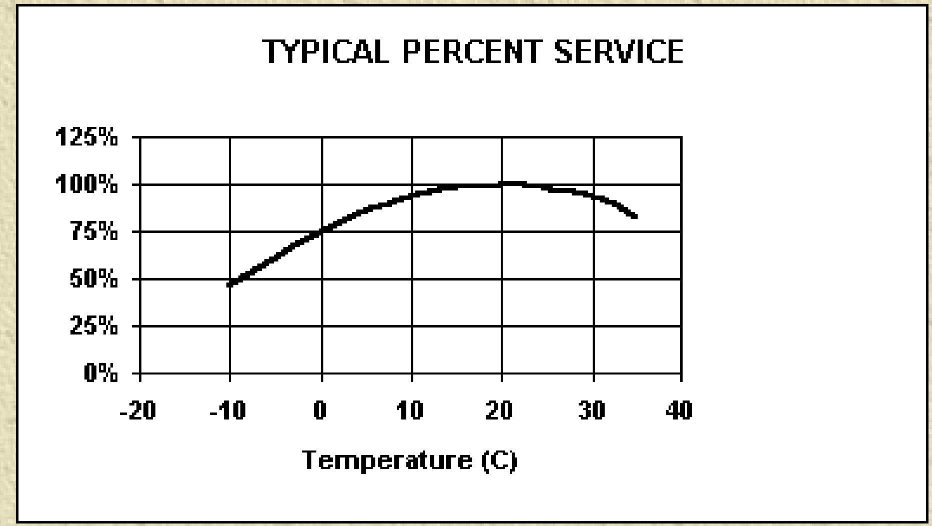


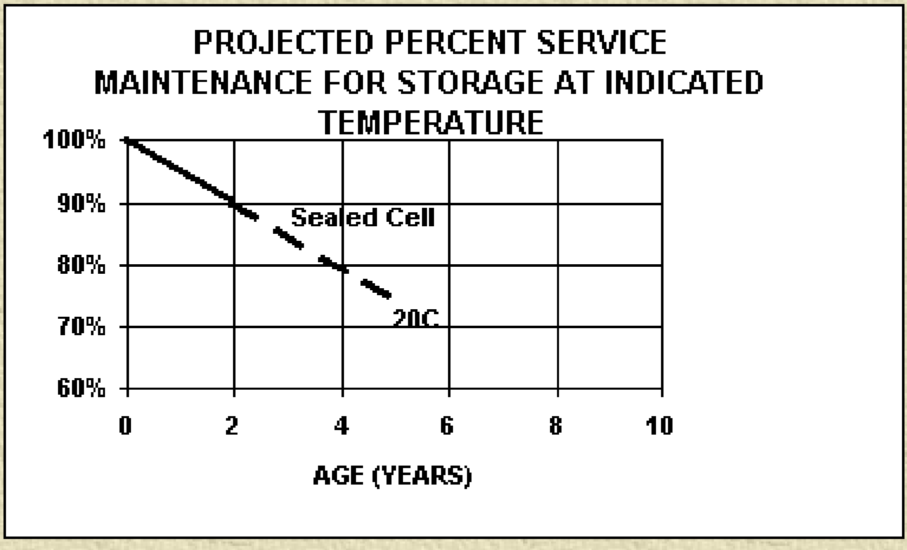
The key to miniature zinc air battery shelf life is the tab seal. This seal should not be removed until the battery is put into service. Miniature zinc air batteries stored at room temperature with the tabs left in place and subjected to typical hearing aid service tests show 95% of initial service after one year and 90% after two years. Accelerated testing indicates that room temperature service maintenance at four years should exceed 85%.

The activated (tab off) air cell batteries have an expected fresh capacity maintenance, depending on cell size, of 50% after 3-12 weeks at 20ºC (68ºF). Beyond 20 weeks, at 20ºC (68ºF), fresh capacity maintenance drops to 0-10%. It is therefore very important to keep the tab seal in place until usage.

Temperature:

The temperature range in which these batteries can be used in a continuous mode is -10ºC to 55ºC. At high temperatures, however, the batteries will lose water rapidly and this loss will limit the length of service.





Applications:

"Air Cell" batteries are especially effective in high to medium drain applications that will use the batteries capacity within a few weeks after opening the seal. Applications falling within this usage time will achieve the high energy density advantage: the highest capacity-to-volume ratio for any miniature battery system. Hearing aids and pagers are typical devices which fit this usage time parameter.

This reference manual contains general information on all Energizer/Eveready batteries within the Zinc Air chemical system in production at the time of preparation of the manual. Since the characteristics of individual batteries are sometimes modified, persons and businesses that are considering the use of a particular battery should contact the nearest Energizer Sales Office for current information. None of the information in the manual constitutes a representation or warranty by Eveready Battery Company, Inc. concerning the specific performance or characteristics of any of the batteries or devices.

Back to Top of Page

Back to Battery Data Home Page

RECHARGEABLE Nickel-Metal Hydride

- Product Offerings

INTRODUCTION

Mobility is increasingly viewed as an essential attribute of today's lifestyles, both personal and professional. Advanced electronic devices such as cellular phones, portable computers and power tools now permit people on the go to operate more effectively than was possible in home, office and work environments of a generation ago. But the price of greater mobility has increased the demands and dependence on portable power sources.

Fortunately, with the development of new Nickel-Metal Hydride (NiMH) battery options, improvements in electronics have now been matched by significant improvements in the batteries that power them. Nickel-Metal Hydride battery cells provide more power (in equivalently sized packages) than Nickel Cadmium (NiCd) cells while also eliminating some of the environmental concerns over the use of heavy metals in the cells.

This manual provides an introduction to this exciting new battery technology while presenting recommendations for use of Nickel-Metal Hydride cells that will provide optimum results in battery-powered products.

Advantages of the Nickel-Metal Hydride Cell
The three major benefits of the Nickel-Metal Hydride cells to designers of portable electrical and electronic products are:

- Improved energy density (up to 40 percent greater than Nickel Cadmium cells) which can be translated into either longer run times from existing batteries or reductions in the space necessary for the battery.
- Elimination of the constraints on cell manufacture, usage, and disposal imposed because of concerns over cadmium toxicity.
- Simplified incorporation into products currently using Nickel Cadmium cells because of the many design similarities between the two chemistries.

Typical Applications
The Nickel-Metal Hydride cell is currently finding widespread application in those high-end portable electrical and electronic products were battery performance parameters, notably run time, are a major consideration in the purchase decision. First adoption of the Nickel-Metal Hydride cell occurred in two markets, cellular phones and portable computers, which are growing dramatically thanks to significant reductions in weight and volume coupled with major improvements in performance. The second major adoption was in the power tool market where additional operating time and high power are of major importance. Examples of the range of products currently powered by Nickel-Metal Hydride batteries are shown in Figure 1 below. Penetration of the Nickel-Metal Hydride cell technology has been strongest in premium electronic products and power tool devices that require premium performance.

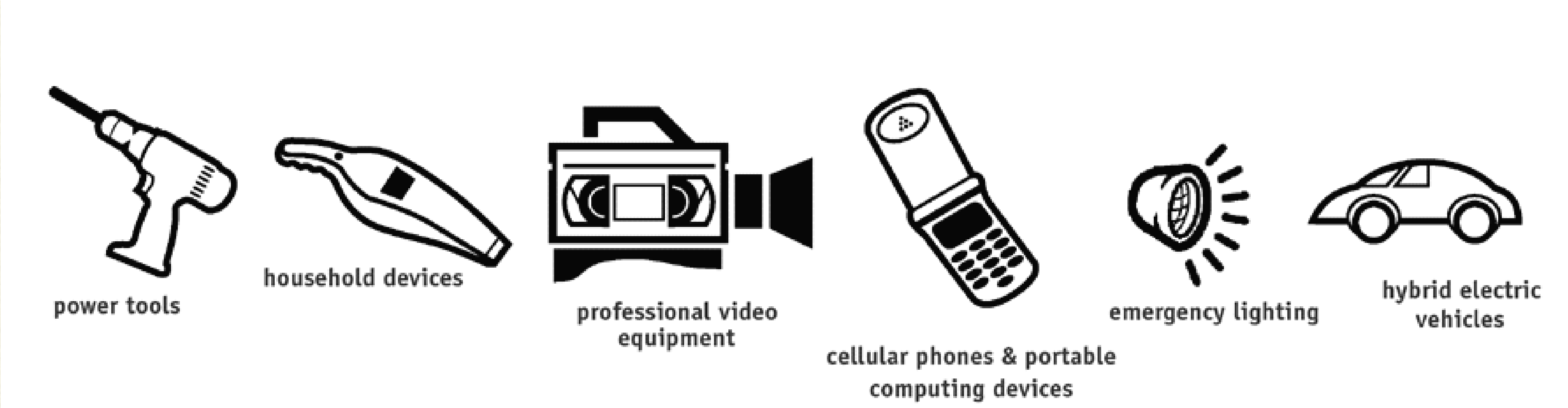


Figure 1.
Examples of products using NiMH cells

Comparison of NiMH and NiCd Cells
Nickel-Metal Hydride cells are essentially an extension of the proven sealed Nickel Cadmium cell technology with the substitution of a hydrogen-absorbing negative electrode for the cadmium-based electrode. While this substitution increases the cell electrical capacity (measured in ampere-hours) for a given weight and volume and eliminates the cadmium which raises toxicity concerns, the remainder of the Nickel-Metal Hydride cell is quite similar to the Nickel Cadmium product. Many application parameters are little changed between the two cell types, and replacement of Nickel Cadmium cells in a battery with Nickel-Metal Hydride cells usually involves few significant design issues. Table 1 compares key design features between the two cell chemistries.

Table 1 - Summary Comparison of Nickel-Metal Hydride Application Features.

Application Feature	Comparison of Nickel-Metal Hydride to Nickel Cadmium Batteries
Nominal Voltage	Same (1.25V)
Discharge Capacity	NiMH up to 40% greater than NiCd
Discharge Profile	Equivalent
Discharge Cutoff Voltages	Equivalent
High Rate Discharge Capability	Effectively the same rates
High Temperature (>35ºC) Discharge Capability	NiMH slightly better than standard NiCd cells
Charging Process	Generally similar; multiple-step constant current with overcharge control recommended for fast charging NiMH

Charge Termination Techniques	Generally similar but NiMH transitions are more subtle. Backup temperature termination recommended.
Operating Temperature Limits	Similar, with NiMH performing slightly better at cold temperatures.
Self-Discharge Rate	Similar to NiCd
Cycle Life	Similar to NiCd
Mechanical Fit	Equivalent
Mechanical Properties	Equivalent
Selection of Sizes/Shapes/Capacities	Equivalent
Handling Issues	Similar
Environmental Issues	Reduced with NiMH because of elimination of cadmium toxicity concerns. Collection of spent NiMH batteries is not mandated.

CELL FUNDAMENTALS

The Nickel-Metal Hydride cell chemistry is a hybrid of the proven positive electrode chemistry of the sealed Nickel Cadmium cell with the energy storage features of metal alloys developed for advanced hydrogen energy storage concepts. This heritage in a positive-limited cell design results in batteries providing enhanced capacities while retaining the well-characterized electrical and physical design features of the sealed Nickel Cadmium cell design.

Electrochemistry
The electrochemistry of the Nickel-Metal Hydride cell is generally represented by the following charge and discharge reactions:

Charge
At the negative electrode, in the presence of the alloy and with an electrical potential applied, the water in the electrolyte is decomposed into hydrogen atoms, which are absorbed into the alloy, and hydroxyl ions as indicated below.
$\text{Alloy} + H_2O + e^- \rightarrow \text{Alloy [H]} + OH^-$

At the positive electrode, the charge reaction is based on the oxidation of nickel hydroxide just as it is in the Nickel Cadmium couple.
$Ni(OH)_2 + OH^- \rightarrow NiOOH + H_2O + e^-$

Discharge:
At the negative electrode, the hydrogen is desorbed and combines with a hydroxyl ion to form water while also contributing an electron to the circuit.
$\text{Alloy [H]} + OH^- \rightarrow \text{Alloy} + H_2O + e^-$

At the positive electrode, nickel oxyhydroxide is reduced to its lower valence state, nickel hydroxide.

$$NiOOH + H_2O + e^- \rightarrow Ni(OH)_2 + OH^-$$

Cell Components

Nickel-Metal Hydride cells, with the exception of the negative electrode, use the same general types of components as the sealed Nickel Cadmium cell.

Negative Electrode

The basic concept of the Nickel-Metal Hydride cell negative electrode emanated from research on the storage of hydrogen for use as an alternative energy source in the 1970s. Certain metallic alloys were observed to form hydrides that could capture (and release) hydrogen in volumes up to nearly a thousand times their own volume. By careful selection of the alloy constituents and proportions, the thermodynamics could be balanced to permit the absorption and release process to proceed at room temperatures and pressures. The general result is shown schematically in Figure 2 where the much smaller hydrogen atom is shown absorbed into the interstices of a bimetallic alloy crystal structure.

Two general classes of metallic alloys have been identified as possessing characteristics desirable for battery cell use. These are rare earth/nickel alloys generally based around LaNi5 (the so-called AB5 class of alloys) and alloys consisting primarily of titanium and zirconium (designated as AB2 alloys). In both cases, some fraction of the base metals is often replaced with other metallic elements. The AB5 formulation appears to offer the best set of features for commercial Nickel-Metal Hydride cell applications.

The metal hydride electrode has a theoretical capacity approximately 40 percent higher than the cadmium electrode in a Nickel Cadmium couple. As a result, Nickel-Metal Hydride cells provide energy densities that are 20 to 40 percent higher than the equivalent Nickel Cadmium cell.

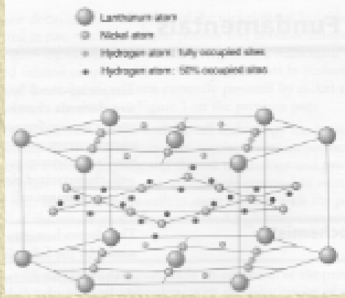


Figure 2.
Schematic of Metal-Alloy Crystal Structure Within Nickel-Metal Hydride Negative Electrode

Positive Electrode

The Nickel-Metal Hydride positive electrode design draws heavily on experience with Nickel Cadmium electrodes. Sintered-type positive electrodes are economical and rugged while exhibiting excellent high-rate performance, long cycle life, and good capacity.

The balance between the positive and negative electrodes is adjusted so that the cell is always positive-limited as illustrated in Figure 3. This means that the negative electrode possesses a greater capacity than the positive. The positive will reach full capacity first as the cell is charged. It then will generate oxygen gas that diffuses to the negative electrode where it is recombined. This oxygen cycle is a highly efficient way of handling moderate overcharge currents.

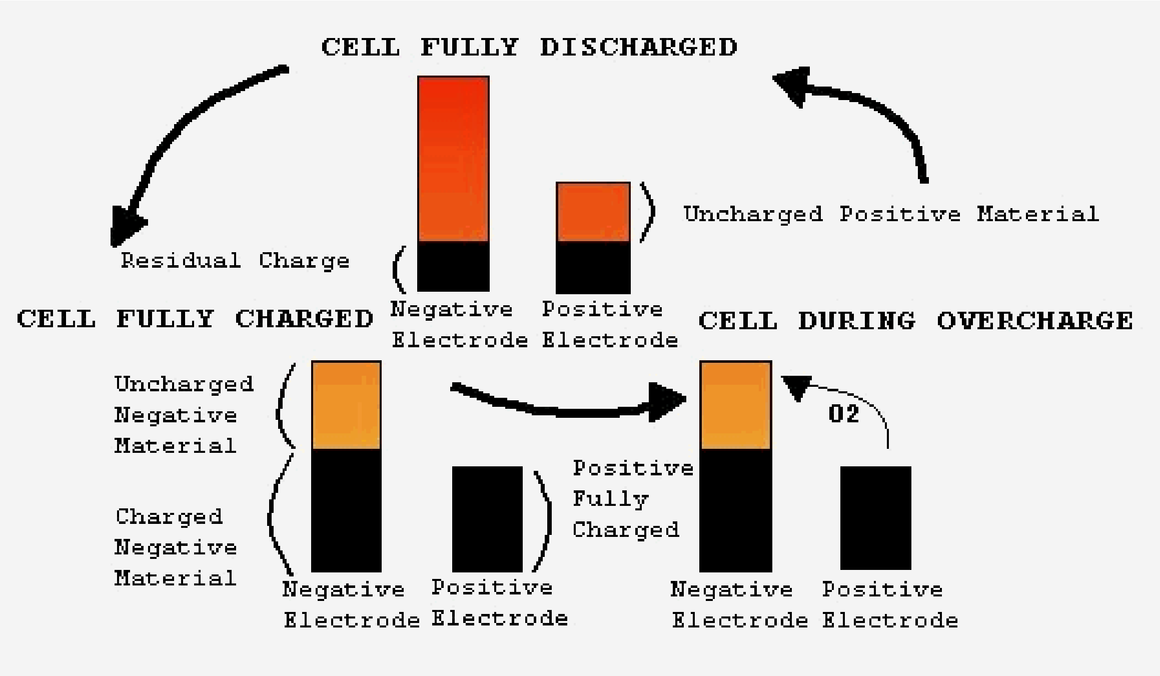


Figure 3
Relative Electrode Balances for Nickel-Metal Hydride Cell During Discharge/Charge/Overcharge

Electrolyte
The electrolyte used in the Nickel-Metal Hydride cell is alkaline, a dilute solution of potassium hydroxide containing other minor constituents to enhance cell performance.

Separator
The material which provides electrical isolation between the electrodes while still allowing efficient ionic diffusion between them.

Cell Construction
The Nickel-Metal Hydride couple lends itself to the wound construction shown in Figure 4, which is similar to that used by present-day cylindrical Nickel Cadmium cells. The basic components consist of the positive and negative electrodes insulated by separators. The sandwiched electrodes are wound together and inserted into a metallic can that is sealed after injection of a small amount of electrolyte. In variation of this design, Nickel-Metal Hydride cells are also being produced in prismatic versions such as that illustrated in Figure 5. The prismatic cells may fit more easily into volume-critical applications.

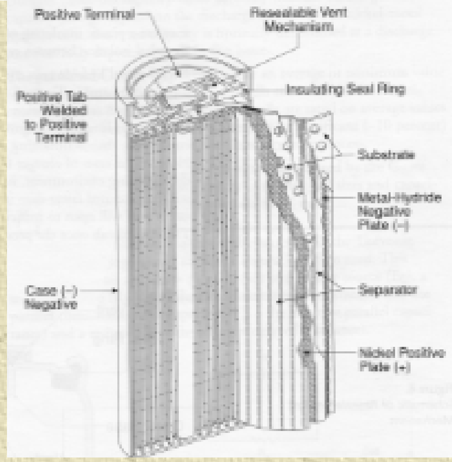


Figure 4.
Schematic of Cylindrical Cell Construction
click here for PDF cross section

The general internal construction of the prismatic cell is similar to the cylindrical cell except the single positive and negative electrodes are now replaced by multiple electrode sets. Thus the trade-off for improved packaging in select applications is increased complexity in cell assembly with the corresponding increases in production cost.

Both cylindrical and prismatic Nickel-Metal Hydride cells are typically two-piece sealed designs with metallic cases and tops that are electrically insulated from each other. The case serves as the negative terminal for the cell while the top is the positive terminal.

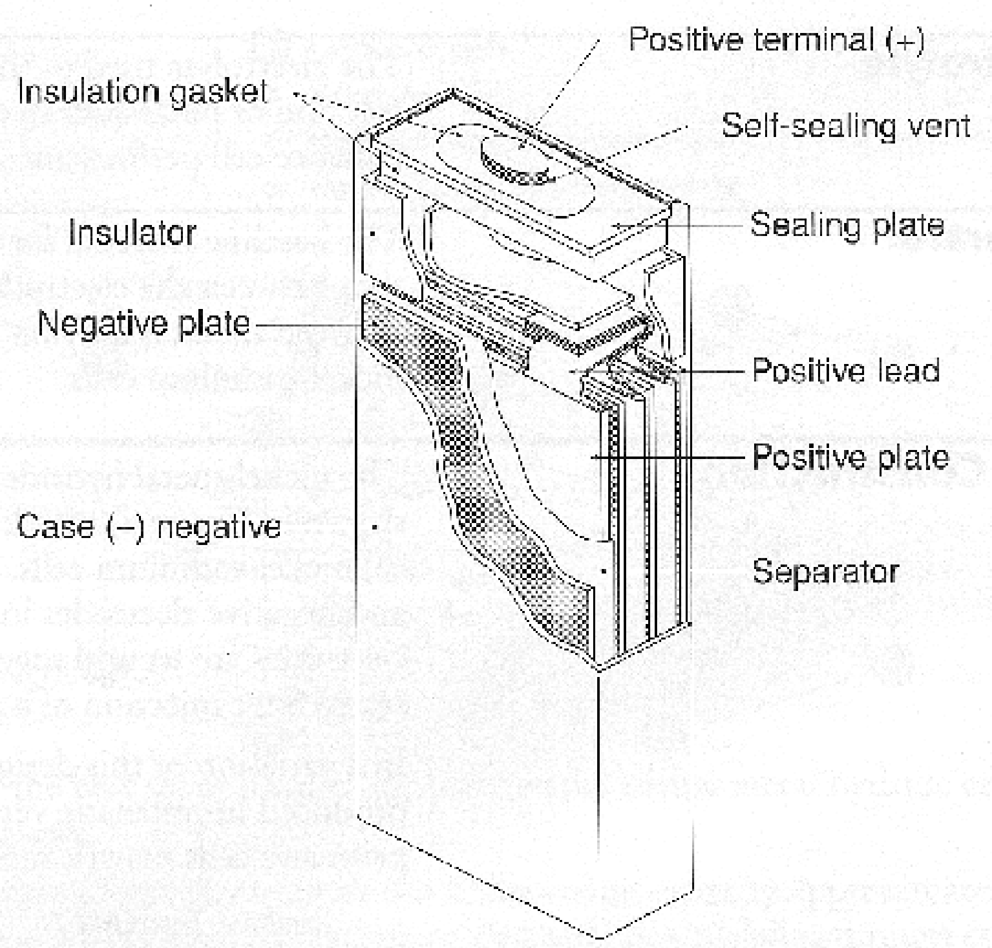


Figure 5.
Schematic of Prismatic Cell Construction

Some finished cell designs may use a plastic insulating wrapper shrunk over the case to provide electrical isolation between cells in typical battery applications.

Nickel-Metal Hydride cells contain a resealable safety vent built into the top, as illustrated in Figure 6. The Nickel-Metal Hydride cell is designed so the oxygen recombination cycle described earlier is capable of recombining gases formed during overcharge under normal operating conditions, thus maintaining pressure equilibrium within the cell. However, in cases of charger failure or improper cell/charger design for the operating environment, it is possible that oxygen, or even hydrogen, will be generated faster than it can be recombined. In such cases the safety vent will open to reduce the pressure and prevent cell rupture. The vent reseals once the pressure is relieved.

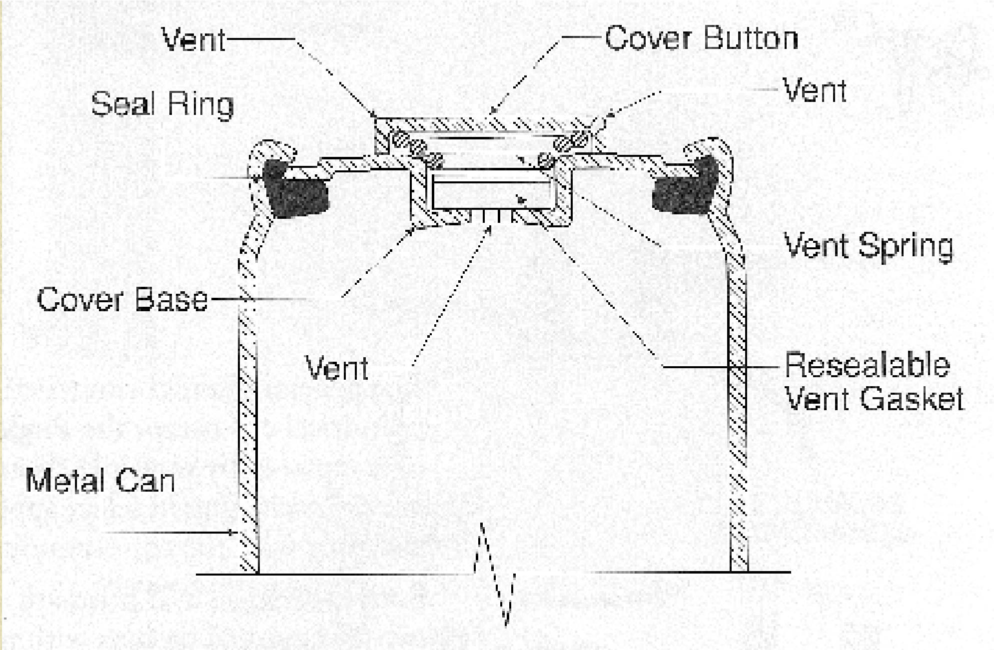


Figure 6.
Schematic of Resealable Vent Mechanism

DISCHARGE PERFORMANCE

The discharge behavior of the Nickel-Metal Hydride cell is generally well-suited to the needs of today's electronic and power tool products - especially those requiring a stable voltage for extended periods of operations.

Definitions of Capacity
The principal battery parameter of interest to a product designer is usually the run time available under a specified equipment use profile. While establishing actual run times in the product is vital prior to final adoption of a design, battery screening and initial design are often performed using rated capacities. Designers should thoroughly understand the conditions under which a cell rating is established and the impact of differences in rating conditions on projected performance. The standard cell rating, often abbreviated as C, is the capacity obtained from a new, but thoroughly conditioned cell subjected to a constant-current discharge at room temperature faster being optimally charged. Since cell capacity varies inversely with the discharge rate, capacity ratings depend on the discharge rate used. For Nickel-Metal Hydride cells, the rated capacity is normally determined at a discharge rate that fully depletes the cell in five hours. The published C value may reflect either an average or minimum value for all cells. Typically Nickel Cadmium cells are rated based on minimum values while Nickel-Metal Hydride cells are rated on average values. The difference between the two values may be significant (~ 10 percent) depending on the variability in the manufacturing process. Many charge and discharge parameters are normalized by the C rate since cell performance within a family of varying cell sizes and capacities is often identical when compared on the C basis.

Equivalent Circuit
For purposes of electrical analysis of the battery cell, the Thevenin equivalent discharge circuit shown in Figure 7 is often used. This models the circuit as a series combination of a voltage source (Eo), a series resistance (Rh = the effective instantaneous resistance), and the parallel combination of a capacitor (Cp = the effective parallel capacitance) and a resistor (Rd = the effective delayed resistance).

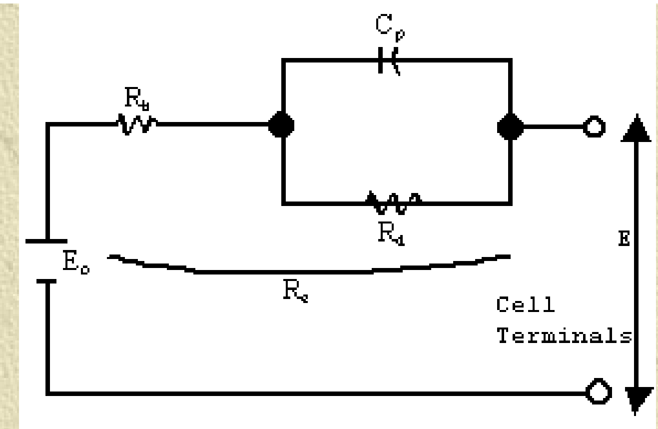


Figure 7.
Equivalent Discharge Circuit for a NiMH Cell.

Equivalent Discharge Circuit for a Nickel-Metal Hydride Cell
Eo = effective cell no-load voltage
Re = (Rh = Rd) = total effective internal resistance
Rh = effective instantaneous resistance
Rd = effective delayed resistance
Cp = effective parallel capacitance
E = cell termination voltage

For steady state purposes, the cell voltage at a given current is Eo - iRe, where Re, the effective internal resistance, is the sum of Rh and Rd. The transient response is shown in Figure 8 where the initial voltage drops immediately to Eo - iReh and then transfers exponentially (with a time constant = Cp *Rd) to the steady-state voltage. Obviously the process reverses when the load is reduced or removed. For many applications, the steady-state voltage is adequate for describing cell performance since the time constant for most cells is small: usually less than 3 percent of the discharge time.

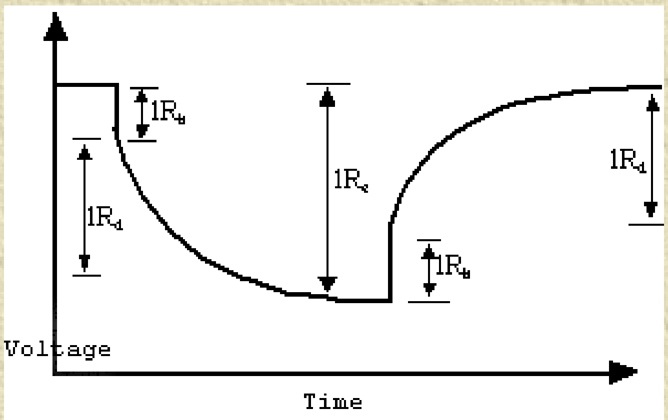


Figure 8.
Example of Transient Voltage Profile for a Nickel-Metal Hydride Cell

Voltage During Discharge
The discharge voltage profile, in addition to the transient effects discussed above, is affected by environmental conditions, notably discharge temperature and discharge rate. However, under most conditions the voltage curve retains the flat plateau desirable for electronics and power tool applications.

Shape of Discharge Curve

A typical discharge profile for a cell discharged at the 5-hour rate (the 0.2C rate) is shown in Figure 9. The initial drop from an open-circuit voltage of approximately 1.4 volts to the 1.2 volt plateau occurs rapidly.

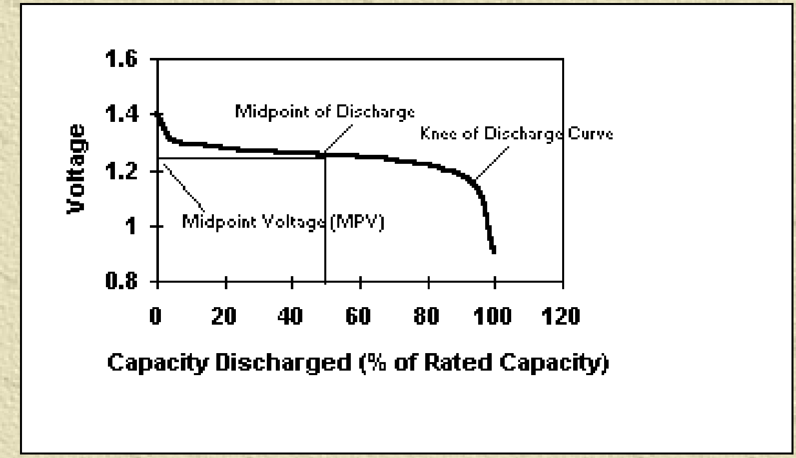


Figure 9.
Typical Discharge Voltage Profile for a Nickel-Metal Hydride Cell

Then, as with Nickel Cadmium cells, the Nickel-Metal Hydride cell exhibits a sharp "knee" at the end of the discharge where the voltage drops quickly. As can be seen by the flatness of the plateau and the symmetry of the curve, the mid-point voltage (MPV - the voltage when 50 percent of the available capacity is discharged) provides a useful approximation to average voltage throughout the discharge.

Environmental Effects

The principal environmental influences on the location and shape of the voltage profile are the discharge temperature and discharge rate. As indicated in Figure 10, small variations from room temperature (± 10ºC) will not appreciably affect the Nickel-Metal Hydride cell voltage profile. However major excursions, especially lower temperatures, will reduce the mid-point voltage while maintaining the general shape of the voltage profile.

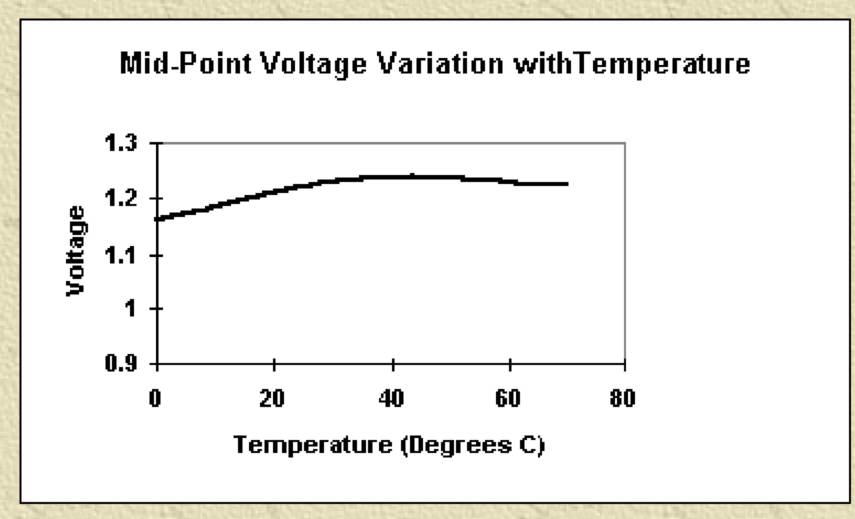


Figure 10.
Mid-Point Voltage Variation with Temperature

Discharge Rate

The effect of discharge rate on voltage profile is shown in Figure 11. There is no significant effect on the shape of the discharge curves for rates under 1C; for rates over 1C, both the beginning and ending transients consume a larger portion of the discharge duration.

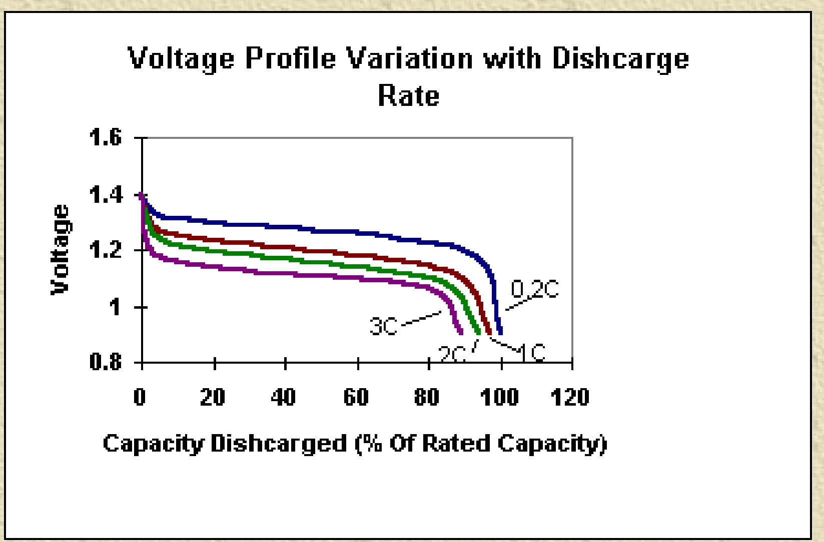


Figure 11.
Voltage Profile Variation with Discharge Rate

Discharge Capacity Behavior

As with the voltage profile, the capacity available during a discharge is dramatically affected by the cell temperature during discharge and the rate of discharge. The capacity is also heavily influenced by the operating history of the cell, i.e. the recent charge/discharge/storage history of the cell. Obviously a cell can only discharge the capacity which has been returned to it from the previous charge cycle less whatever is lost to self discharge. Charging/charge return issues are discussed in the next section while storage and self-discharge is addressed in a later section.

Effect of Temperature

The primary effects of lower cell temperatures (< 0ºC) on dischargeable capacity, assuming adequate charging, are slight derating of capacity from room-temperature values.

Effect of Discharge Rate

There is no significant effect on capacity for discharge rates below 1C. At the discharge rates above 1C reductions in voltage delivery occur. This voltage reduction may also result in capacity reduction depending on the Nickel-Metal Hydride cell design chosen and the discharge termination voltage as discussed earlier.

Discharge Application Considerations

In general, the discharge behavior of Nickel-Metal Hydride cells closely follows that of similar Nickel Cadmium cells used in the same environment. Thus much of the design expertise gathered for Nickel Cadmium cells is directly applicable to Nickel-Metal Hydride cells. Discussed below are some specific issues often raised by designers using Nickel-Metal Hydride cells. As the Nickel-Metal Hydride experience base builds, additional information that will help designers optimize the use of Nickel-Metal Hydride cells is becoming available. For this reason, close consultation with the factory during the design effort is encouraged.

State-of-Charge Measurement

A major issue for users of portable electronics is the run time left before they need to recharge their batteries. Users of portable computers, in particular, expect some form of "fuel gauge" to help them determine when they need to save their work. A variety of schemes for measuring state-of-charge have been suggested. In general, experience with Nickel-Metal Hydride cells indicates that, due to the flatness of the voltage plateau under normal discharge rates, voltage sensing cannot be used to accurately determine state-of-charge. To date, the only form of state-of-charge sensing found to consistently give reasonable results is coulometry; comparing the electrical flows during charge and discharge to indicate the capacity remaining. Many devices already have the electronics available to perform sophisticated tracking of charge flows including estimation of self-discharge losses. With careful initial calibration and appropriate compensation for environmental conditions, predictions accurate within 5 to 10 percent of actual capacity have been demonstrated. Moltech Power Systems has developed the expertise to incorporate electronic solutions that make accurate state-of-charge measurements possible.

Memory/Voltage Depression

The issue of "memory" or voltage depression has been a concern for many designers of devices, using Nickel Cadmium cells. In some applications where Nickel Cadmium cells are routinely partially discharged, a depression in the discharge voltage profile of approximately 150 mV per cell has been reported when the discharge extends from the routinely discharged to rarely discharged zones. While the severity of this problem in Nickel Cadmium cells is open to differing interpretations, the source of the effect is generally agreed to be in the structure of the cadmium electrode. With the elimination of cadmium in the Nickel-Metal Hydride cell, memory is no longer a major concern.

Discharge Termination

To prevent the potential for irreversible harm to the cell caused by cell reversal in discharge, removal of the load from the cell(s) prior to total discharge is highly recommended. The typical voltage profile for a cell carried through a total discharge involves a dual plateau voltage profile as indicated in Figure 12. The voltage plateaus are caused by the discharge of first the positive electrode and then the residual capacity in the negative. At the point both electrodes are reversed, substantial hydrogen gas evolution occurs, which may result in cell venting as well as irreversible structural damage to the electrodes. It should be noted that the Nickel-Metal Hydride cell, because it uses a negative electrode that absorbs hydrogen, may actually be somewhat less susceptible to long-term damage from cell reversal than the sealed Nickel Cadmium cell.

The key to avoiding harm to the cell is to terminate the discharge at the point where essentially all capacity has been obtained from the cell, but prior to reaching the second plateau where damage may occur. Two issues complicate the selection of the proper voltage for discharge termination: high-rate discharges and multiple-cell effects in batteries.

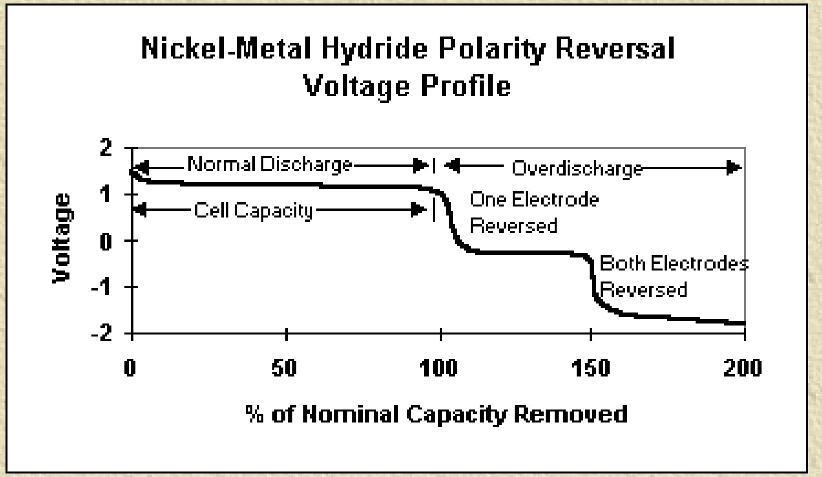


Figure 12.
Nickel-Metal Hydride Cell Polarity Reversal Voltage Profile

Voltage Cutoff at High Rates

Normally discharge cutoff is based on voltage drops with a value of 0.9 volts per cell (75 percent of the 1.2 volt per cell nominal mid-point voltage) often being used. As can be seen in Figure 11, 0.9 volts is an excellent value for most medium to long-term discharge applications (< 1C). However, again as seen in Figure 11, with high drain-rate usage, the change in shape in the voltage curve with the more rounded "knee" to the curve means that an arbitrary 0.9V/cell cutoff may be premature, leaving a significant fraction of the cell capacity untapped. For this reason, a better choice for voltage cutoff in high-rate applications is 75 percent of the mid-point voltage at that discharge rate. Note, however, that this choice of end-of-discharge voltage (EODV) is dictated only by considerations of preventing damage to the cell. There may be end-application justification for selection of a higher voltage cutoff with the resulting sacrifice of some potential additional capacity.

Discharge Termination in Batteries

Normal manufacturing variation produces a range of capacities for battery cells. As these cells are combined in batteries, the effects of cell capacity variations are amplified by the number of cells in the battery. Use of termination voltage based on a simple multiple of 0.9V/cell times the number of cells may result in a weaker cell being driven into reverse significantly before the battery reaches the termination voltage. Both charging techniques that minimize the amount of overcharge applied to the cell and frequent repetitive discharging of the battery may exacerbate the problem. The result may be premature battery failure due to the damage caused by reversal of the weak cell. Experience indicates selection of the EODV by the following formula provides acceptable margin to minimize battery failure from repeated cell polarity reversal:

EODV = [(MPV-150mV)(n-1)] - 200mV where MVP is the single-cell mid-point voltage at the given discharge rate and n is the number of cells in the battery. Selection of the proper discharge termination voltage, especially for large batteries or complicated application profiles, should be done in consultation with the cell manufacturer.

CHARGE CHARACTERISTICS

Proper charging of Nickel-Metal Hydride cells is the key to satisfaction with their performance in any product. A successful charging scheme balances the need for quick, thorough charging with the need to minimize overcharging, a key factor in prolonging life. In addition, a selected charging scheme should be economical and reliable in use.

In general, the Nickel-Metal Hydride cell appears to be more sensitive to charging conditions than the Nickel Cadmium cell. For this reason, charging strategies should be selected and charging parameters established in consultation with the cell manufacturer. One advantage today's application designers do have in developing chargers for Nickel-Metal Hydride cells is the increasing availability of packaged charger circuits.

Charging Summary
The keys to successful charging of Nickel-Metal Hydride cells are:

- Use a three-step charging strategy to speed return to service while minimizing excessive overcharge.
- Design for more subtle indications of entry into overcharge.
- Use redundant fast-charge termination techniques.
- Provide fail-safe charge-termination backup (thermal fuse, etc.).

When these guidelines are followed, Nickel-Metal Hydride cells can be quickly and reliably charged while maximizing cycle life.

Cell Behavior During Charge
Unlike discharge performance where the behavior of Nickel-Metal Hydride cells and traditional Nickel Cadmium cells is very similar, there are significant differences in behavior on charge between the two cell types that relate to basic electrochemical differences. Specifically Nickel Cadmium cells are endothermic on charge while Nickel-Metal Hydride cells are exothermic. This difference is manifested in the interrelationships among voltage, pressure, and temperature as discussed below.

Voltage, Pressure, Temperature Interrelationships
Figure 13 sketches typical behavior of a Nickel-Metal Hydride cell being charged at the 1C rate. These curves both indicate why charge control is important and illustrate some of the cell characteristics used to determine when charge control should be applied.

The voltage spikes up on initial charging then continues to rise gradually through charging until full charge is achieved. Then as the cell reaches overcharge, the voltage peaks and then gradually trends down. Since the charge process is exothermic, heat is being released throughout charging giving a positive slop to the temperature curve. When the cell reaches overcharge where the bulk of the electrical energy input to the cell is converted to heat, the cell temperature increases dramatically. Cell pressure, which increases somewhat during the charge process, also rises dramatically in overcharge as greater quantities of gas are generated at the C rate than the cell can recombine. Without a safety vent, uncontrolled charging at this rate could result in physical damage to the cell.

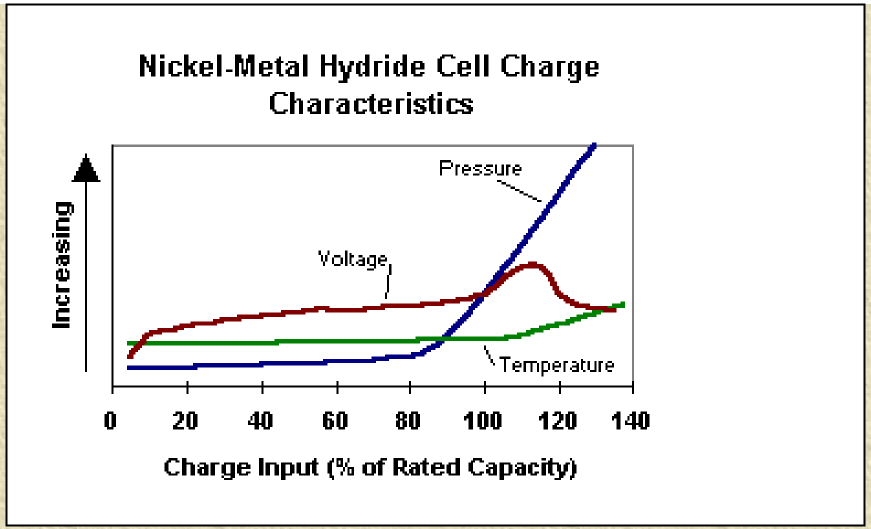


Figure 13.
Nickel-Metal Hydride Cell Charging Characteristics

Charge Acceptance at Temperature
The effect of temperature on charging efficiency (the increase in cell capacity per unit of charge input) is one area of difference between Nickel-Metal Hydride and Nickel Cadmium cells. Specifically charge acceptance in the Nickel-Metal Hydride cell (as shown in Figure 14) decreases monotonically with rising temperature beginning below 20°C and continuing through the upper limits of normal cell operation. This contrasts with the Nickel Cadmium cell which has a peak in charge acceptance in the vicinity of room temperature. With either cell type, the drop in charge acceptance at higher temperatures remains a significant concern to product designers who are mounting the cells in close proximity to heat sources or in compartments with limited cooling or ventilation.

Rate Effect on Charge Acceptance
Figure 15 indicates that the charge acceptance efficiency for the Nickel-Metal Hydride cell is improved as the charging rate is increased.

Overcharge Detection
Determining when overcharge has occurred is critical to charging schemes that minimize the amount of time spent at high charge rates in overcharge. In turn, these efficient charging techniques are a key to maximizing cell life, as will be discussed later. Primary charge control schemes typically depend on sensing either the dramatic rise in cell temperature illustrated in Figure 16 or the peak in voltage show in Figure 17.

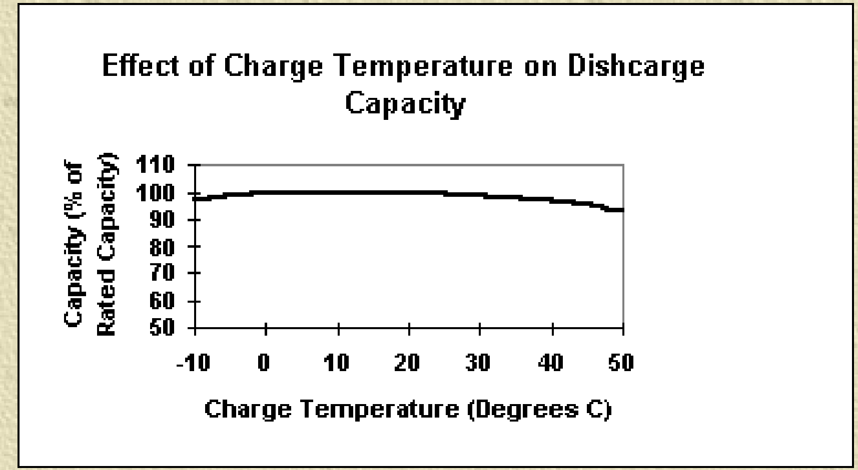


Figure 14.
Effect of Charge Temperature on Discharge Capacity

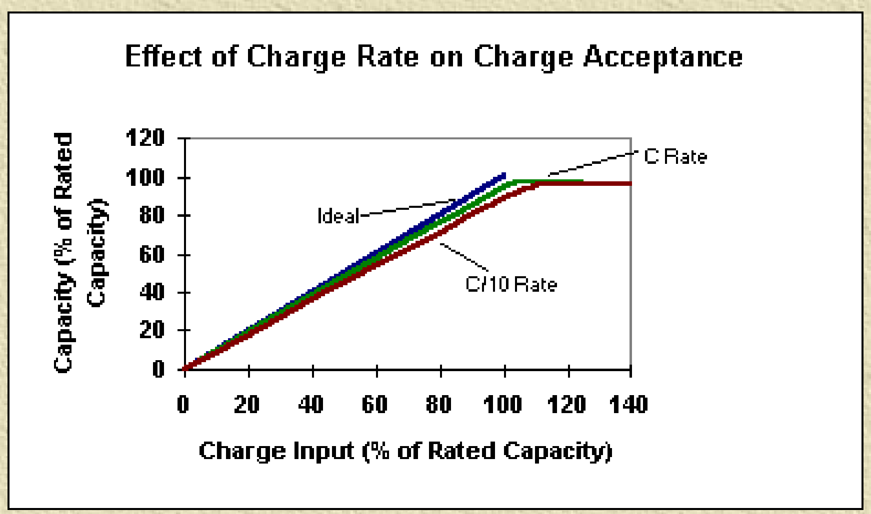


Figure 15.
Effect of Charge Rate on Charge Acceptance

Charge control based on temperature sensing is the most reliable approach to determining appropriate amounts of charge for the Nickel-Metal Hydride cell. Temperature-based techniques are thus recommended over voltage-sensing control techniques for the primary charge control mechanism.

Recommended Charging Rates
Today's trend to faster charge times requires higher charge rates than the 0.1 to 0.3C rates often recommended for many Nickel Cadmium charging systems. Both Figure 16 and 17 indicate that fast-charge rates serve to accentuate the slope changes used to trigger both the temperature and voltage-related charge terminations. A charge rate of 1C is recommended for restoring a discharge cell to full capacity. For charging schemes that then rely on a timed "topping' charge to ensure complete charge, a rate of 0.1C appears to balance adequate charge input with minimum adverse effects in overcharge. Finally a maintenance (or trickle) charge rate of 0.025C (C/40) is adequate to counter self-discharge and maintain cell capacity.

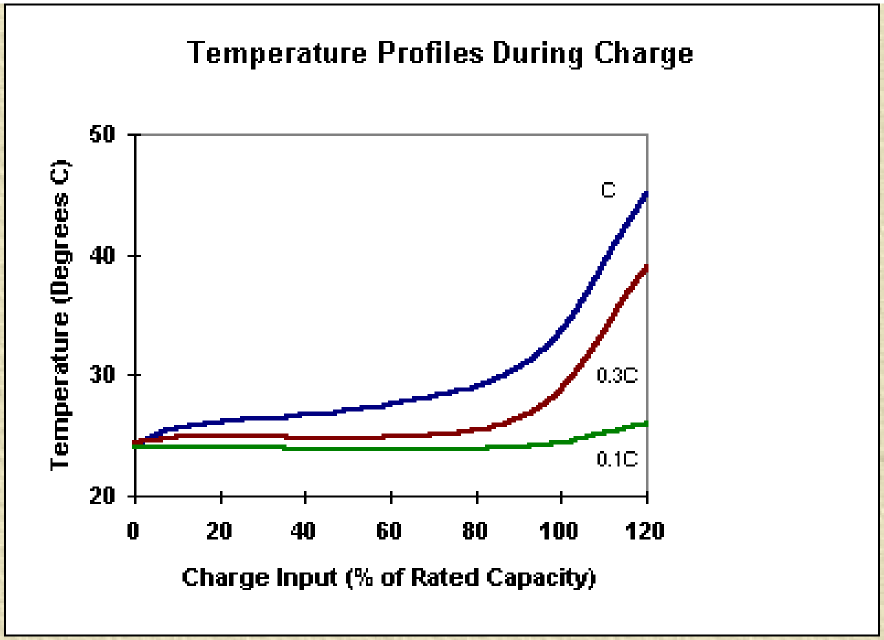


Figure 16.
Temperature Profiles During Charge

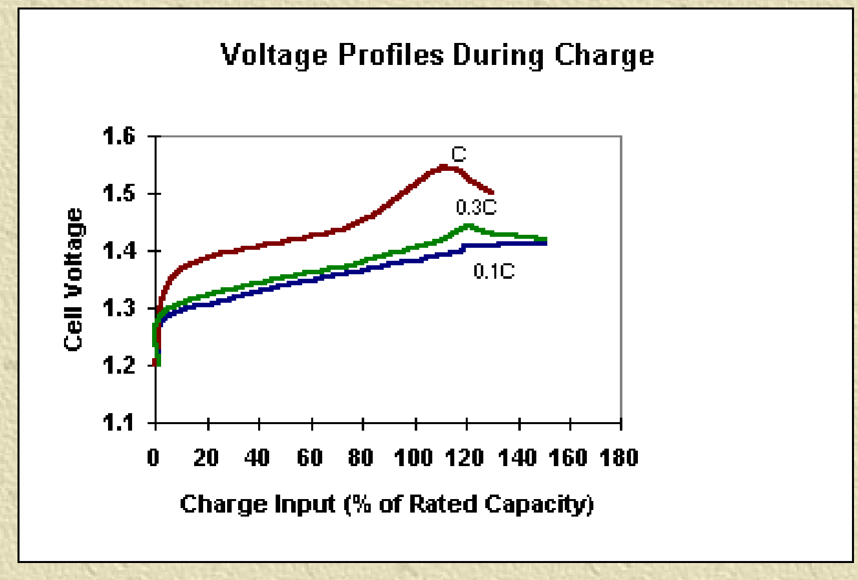


Figure 17.
Voltage Profiles During Charge

Effective Charging Strategies
Products using Nickel-Metal Hydride cells often make use of the sophistication of today's chip-level packaged charging systems to tailor the charging profile to fast

capacity recovery while minimizing overcharge stress. Two general classes of strategies have evolved:

Two-Stage:
This approach uses a timer to switch from the initial charge rate to the maintenance charge rate. Because there is no sensing of the cell's transition into overcharge, the charge rate must be kept low (0.1C) to minimize overcharge-related impact on cell performance and life. Charge durations are typically set at 16 to 24 hours to ensure full recharge in cases of complete discharge. Although economical, since this scheme makes no allowance for the degree of discharge or for environmental conditions, its use is rarely recommended for typical Nickel-Metal Hydride applications.

Three-Stage:
Here a fast charge restores approximately 90 percent of the discharged capacity, an intermediate timed charge completes the charge and restores full capacity, then a maintenance charge provides a continuous trickle current to balance the cells and compensate for self-discharge. The fast charge (with currents in the 1C range) is typically switched to the intermediate charge using a temperature-sensing technique which triggers at the onset of overcharge. The intermediate charge normally consists of a 0.1C charge for a timed duration selected based on battery pack configuration. This intermediate-charge replaces the need to fast-charge deeply into the overcharge regime to ensure that the cell has received a full charge. Three-step charging, such as illustrated in Figure 18, requires greater charger complexity (to incorporate a second switch point and third charge rate), but reduces cell exposure to life-limiting overcharge.

Charging System Redundancy
Because of the sensitivity of cell life to overcharge history and the greater subtlety of some of the overcharge transitions, charge termination redundancy in charger design is recommended. This applies to both built-in redundant charge control techniques and fail-safe charge termination techniques such as thermal fusing. Both of these considerations are discussed in more detail in the cell and battery design sections.

Temperature-Based Charge Control
Use of charge control based on the temperature rise accompanying the transition of the cell to overcharge is generally recommended because of its reliability (when compared to voltage peak sensing techniques) in sensing overcharge. However, temperature sensing is typically more expensive to implement than voltage sensing since it requires additional sensors. The exothermic nature of the Nickel-Metal Hydride charge process (as illustrated in Figure 16) results in increasing temperature throughout charging. This requires care in selection of setpoints to avoid premature charge termination.

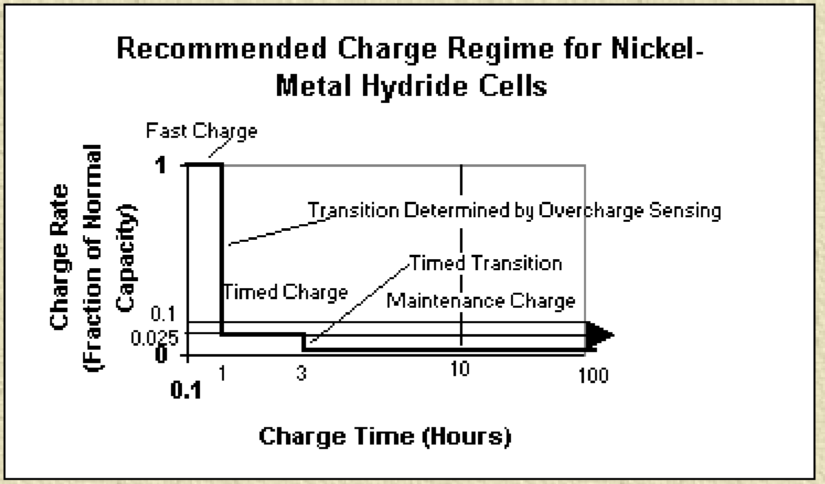


Figure 18.
Recommended Charge Regime for Nickel-Metal Hydride Cells

$\Delta T/\Delta t$
Charge switching based on the change in slope of the temperature profile eliminates much of the influence of the external environment and can be a very effective technique for early detection of overcharge in a three-step charging scheme.

ΔTCO

The simple form of temperature-based switching is to use an absolute increment in temperature from the start of charging, e.g. a 20°C increase in cell temperature from onset of charge. The chosen ΔT has to account for both normal temperature gain during charge and the spike at overcharge. Selection of the proper temperature increment can be greatly influenced by the environment surrounding the cell. Thus it should be done based on bench testing of the cell in the application and done after consultation with the cell manufacturer.

Maximum Temperature
Charge switching based on the absolute cell temperature (as opposed to temperature increment) is subject to varying use patterns—Alaska or the Sahara—and is recommended only as a fail-safe strategy to avoid destructive heating in case of failure of the primary switching strategy.

Voltage-Based Charge Control
Charge control based on voltage changes is attractive because it can be accomplished using only existing leads to the battery, eliminating the expense and complexity of additional temperature-sensing leads to the cell. However, the voltage peak typically occurs later in the overcharge process, the voltage overcharge is not as distinct as that seen with temperature, and the voltage behavior may change with cycling. For these reasons, most product designers choose to use voltage-sensing techniques only as backups to temperature-based control.

dV/dt
Despite the concerns voiced above, Figure 17 does indicate a significant knee to the voltage early in overcharge when charging at the 1C rate. Sensing this slope change in a dV/dt (or Δv/Dt) system can provide an effective economical approach to detecting early entry to overcharge.

+ΔV
Sensing the absolute voltage rise, if carefully performed, can be a useful charge control strategy. It can be most easily utilized if cells are usually fully discharged prior to recharge. This approach is subject to the same caveats mentioned previously regarding consultation and bench-level verification.

- ΔV
Since the voltage does peak during overcharge, switching on the voltage decrease is feasible. This eliminates the concerns faced in both voltage and temperature increment methods about determining the increment that ensures charge return without excessive overcharge.

Magnitude
Charge control through the absolute value of the voltage is relatively imprecise and unsuited for primary charge-control techniques. It can be used as a redundant control technique in, for example, a dV/dt scheme.

Time-Based Charge Control
Timer-controlled charging systems are the simplest and most economical of all charging strategies. However, to avoid adverse effects on cell life and performance, charging rates must be limited to 0.1C, which constrains time-based charging to those products where overnight return of charge is acceptable. In typical application scenarios where the degree of discharge varies widely, a charging system using time as the primary control variable will either undercharge or overcharge the battery. However, time-based redundant charge termination and/or time-based control of intermediate charging (topping charge) in a three-step system are often key elements of an integrated charge-control strategy.

Environmental Influences on Charging Strategy
The discussions above are most pertinent for devices operating in the room-ambient range. Designers of products predominantly operating at either temperature extreme should consult closely with their cell suppliers in designing their charging system.

High Temperature
Although high-temperature performance (in the 40 to 55°C range) is equivalent or even slightly better than the standard Nickel Cadmium product, charging of Nickel-Metal Hydride cells in high-temperature environments requires careful attention for two reasons: (1) the selection of setpoints, for both temperature and voltage-sensing systems, can be affected if the cells are already at elevated temperatures prior to starting charge; and (2) charge duration may have to be extended due to the charge acceptance inefficiencies illustrated in Figure 14.

Low Temperature
Even though low temperature charge acceptance is better for the Nickel-Metal Hydride cell than for Nickel Cadmium cells, designers must ensure that low temperatures do not adversely affect their charge-control scheme. The charge time increases at lower temperatures so charge durations must be carefully considered to provide adequate low-temperature charging while avoiding excessive charge at normal temperatures. Charge rates must also be reduced at low temperatures. Charging below 0°C is not advisable. Consult the factory for more details on low-temperature charging.

Available Battery Charging Systems

Traditionally, application designers tailored their charging system to their application. With the rapid evolution of chip-based charging circuitry, designers can now use standardized designs providing a sophisticated charging scheme while allowing the designer wide latitude in selecting charge parameters. Such systems are available from a variety of sources including both cell manufacturers and integrated-circuit design houses, in forms ranging from basic chip to complete charger packages.

STORAGE

Essentially all rechargeable battery cells gradually discharge over time whether they are used or not. This capacity loss is typically due to slow parasitic reactions occurring within the cell. As such, the loss rate (self-discharge rate) is a function of the cell chemistry and the temperature environment experienced by the cell. Due to the temperature sensitivity of the self-discharge reactions, relatively small differences in storage tempeature may result in large differences in self-discharging rate. Extended storage with a load connected not only speeds the discharge process, but may also cause chemical changes after the cell is discharged, which may be difficult or impossible to reverse.

Cell and battery storage issues of concern to most application designers relate either to the speed with which the cells lose their capacity after being charged or the ability of the cells to charge and discharge "normally" after storage for some period of time. In both situations, general guidelines developed for Nickel Cadmium cells will work acceptably for Nickel-Metal Hydride cells.

Retained Capacity

Figure 19 illustrates the amount of capacity available from Nickel-Metal Hydride cells after standing for a given number of days in four different thermal environments. The common rule of thumb for Nickel Cadmium cells that a 10°C increase in storage temperature halves the time required for a cell to self-discharge to a given level remains approximately correct for Nickel-Metal Hydride cells.

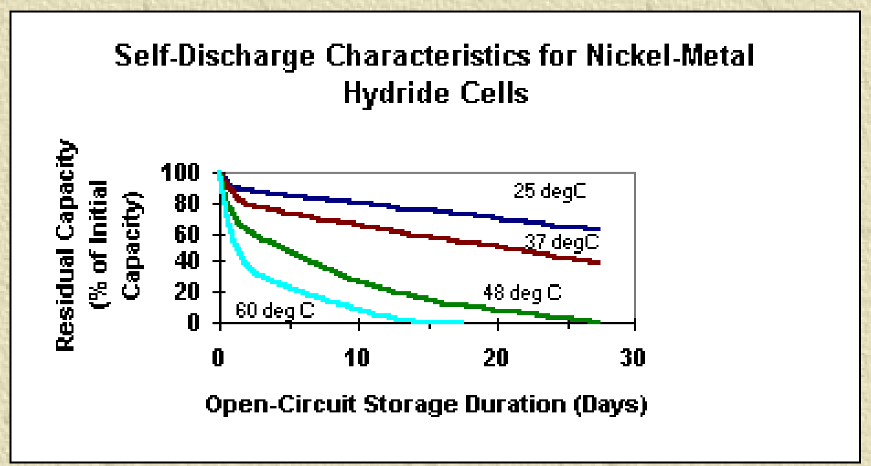


Figure 19.
Self-Discharge Characteristics for Nickel-Metal Hydride Cells

Recommended Storage Conditions

- Storage recommendations for Nickel-Metal Hydride cells parallel those for Nickel Cadmium cells.
- Store at the lowest feasible temperatures (0 to 30°C being the generally recommended storage temperatures).
- Store cells/batteries open-circuit to eliminate loaded storage effects (see next page).
- Storage in a clean, dry, protected environment to minimize physical damage to batteries.
- Use good inventory practices (first in, first out) to reduce time cells spend in storage.

Capacity Recovery After Storage
In normal practice, stored cells will provide full capacity on the first discharge after removal from storage and charging with standard methods. Cells stored for an extended period or at elevated temperatures may require more than one cycle to attain pre-storage capacities. Consultation with the manufacturer is recommended if prolonged storage and rapid restoration of capacity is planned.

Loaded Storage
Cells and batteries intended for storage for extended periods of time (pass the point where they are fully discharged) should be removed from their load. In particular, many portable electronic devices place a very low-level drain requirement on their batteries even when in the "off" position. These micro-current loads may be sustaining volatile memory, powering sense circuits or even maintaining switch positions. Such loads should be eliminated when storing devices for protracted periods.

When both Nickel-Metal Hydride cells and Nickel Cadmium cells are stored under load, small quantities of electrolyte can ultimately begin to seep around the seals or through the vent. This creep leakage may result in the formation of crystals of potassium carbonate, which detract cosmetically from the appearance of the cell. In extreme cases, creep leakage can result in corrosion of cells, batteries, or the adjoining componetry. Although such occurrences are rare, positive methods of electrically isolating the cell, such as an insulating tape over the positive terminal or removal from the product, are suggested for applications requiring extended storage of cells.

LIFE

A key determinant of the economic and practical feasibility of using Nickel-Metal Hydride cells and batteries in portable electronic applications is the cell's cycle life: the ability of the Nickel-Metal Hydride cell to deliver acceptable capacity on a repetitive basis. Nickel-Metal Hydride cell cycle life has received intensive development attention with the result that operational life expectations are now competitive with those for Nickel Cadmium cells.

Limiting Mechanisms
The life of any battery cell is determined by a combination of abrupt failure events and gradual cell deterioration. With the Nickel-Metal Hydride cell, abrupt failures, typically mechanical events resulting in the cell either shorting or going open-circuit, are relatively rare and randomly distributed.

Cell deterioration can take two forms:

1. Oxidation of the negative active material that increases cell internal resistance resulting in reduction of available voltage from the cell (MPV depression). This also affects the balance between electrodes within the cell and may possibly result in reduced gas recombination, increased pressure, and ultimately, cell venting.
2. Deterioration of the positive active material results in less active material being available for reaction with the consequent loss of capacity.

Both phenomena result in a loss of usable capacity, but pose differing design issues. Mid-point voltage depression requires that the application design be able to adapt to variations in supply voltage from cycle to cycle. Capacity reduction simply requires that initial cell selection be sized to provide adequate capacity at end-of-life for the desired number of cells. The actual mechanism that will determine cell life may vary depending on application parameters and the cell characteristics. Development work has reduced oxidation in the negative electrode reducing the depression in MPV as the cell ages.

Factors Affecting Life
The way the Nickel-Metal Hydride cell is designed into an application can have dramatic effects on the life of the cell. This is especially true of the design of the charging circuitry for the application to ensure adequate return of charge while minimizing overcharge. In fact, effective control of overcharge exposure, time and charge rate is the way of enhancing cell life.

Charge Regime
In general, tailoring the charge regime to the application use scenario is even more important with Nickel-Metal Hydride cells than with Nickel Cadmium cells because of the increased subtlety of the voltage and temperature indications of full charge and the greater sensitivity of cell life to overcharge history.

Degree of Overcharge
Establishing the appropriate degree of overcharge for a battery-powered application is dependent on the usage scenario. Some overcharge of the battery is vital to ensure that all cells are fully charged and balanced, but maintenance of full charge currents for extended periods once the cell has reached full charge can reduce life. The three-step charge process works to minimize some of the overcharge stress. Details of the charging process and the application context should be carefully reviewed

with the cell manufacturer to ensure maximum cell life for the specific application.

Exposure to High Temperatures
In general, higher temperatures accelerate chemical reactions including those which contribute to the aging process within the battery cell. High temperatures are a particular concern in the charging process as charge acceptance is reduced. Sensing the transition from charge to overcharge is also more difficult at higher temperatures. Although early data indicate that Nickel-Metal Hydride cells may tolerate high-temperature charging better than standard Nickel Cadmium cells, close consultation with the cell manufacturer is encouraged to select a charging strategy that meets operational requirements while maximizing cell life.

Cell Reversal
Discharge of Nickel-Metal Hydride batteries to the degree that some or all of the cells go into reverse can shorten cell life, especially if this overdischarge is repeated routinely.

Prolonged Storage under Load
Maintaining a load on a cell (or battery) past the point of full discharge may eventually cause irreversible changes in the cell chemistry and promote life-limiting phenomena such as creep leakage.

DESIGNING FOR NICKEL-METAL HYDRIDE CELLS

Incorporation of Nickel-Metal Hydride cells into applications is generally straightforward, particularly for designers accustomed to designing with Nickel Cadmium cells. Primary differences between the two cell chemistries are:

- Nickel-Metal Hydride cells offer higher energy densities.
- Environmental and occupational health issues relating to cadmium are eliminated with Nickel-Metal Hydride cells.
- More care is required in design of Nickel-Metal Hydride charging systems.
- Since Nickel-Metal Hydride cells may emit hydrogen in heavy overcharge or overdischarge, both charge-control redundancy and location of the battery package in the product deserve careful scrutiny.

Materials of Construction
The materials of construction for the Nickel-Metal Hydride cell external surfaces are, like the Nickel Cadmium cell, largely comprised of nickel-plated steel, and therefore, are resistant to attack by most environmental agents.

Orientation
Nickel-Metal Hydride cells will operate satisfactorily in any orientation.

Environmental Suitability
The Nickel-Metal Hydride cell is designed to operate effectively in all environments normally experienced by portable electronic equipment. Application designers intending to use Nickel-Metal Hydride cells in especially adverse environments should consult closely with the cell manufacturer to ensure design suitability.

Temperature
Like most other battery cells, Nickel-Metal Hydride cells are most comfortably applied in a near-room-temperature environment (25°C); however, with careful attention to design parameters, they can be successfully utilized when exposed to a much wider range of temperatures.

Operating
Nickel-Metal Hydride cells can be successfully applies in temperatures from -20°C to 50°C with appropriate derating of capacity at both the high and low ends of the range. Design charging systems to return capacity in high or low temperature environments without damaging overcharge requires special attention.

Storage
Cells are best stored in temperatures from -40°C to 30°C although storage for limited periods of time at higher temperatures is feasible.

Shock and Vibration

Expect Nickel-Metal Hydride cells to easily withstand the normal shock and vibration loads experienced by portable electronic equipment in day-to-day handling and shipping. Consult with the cell manufacturer regarding applications required operation in more intense shock and vibration environments.

Ventilation and Isolation

The primary gas emitted from the Nickel-Metal Hydride cell when subjected to excessive overcharge is hydrogen as opposed to oxygen for the Nickel Cadmium cell. Although venting of gas to the outside environment should not occur in a properly designed application, isolation of the battery compartment from other electronics (especially mechanical switches that might generate sparks) and provision of adequate ventilation to the compartment are required to eliminate concerns regarding possible hydrogen ignition. Isolation of the battery from heat-generating componetry and ventilation around the battery will also reduce thermal stress on the battery and ease design of appropriate charging systems.

Termination

Since the exterior of the Nickel-Metal Hydride cell is nearly identical to that of the Nickel Cadmium cell, all termination procedures accepted for the Nickel Cadmium cell apply equally well to the Nickel-Metal Hydride cell. The recommendation against use of mechanical (pressure) contacts in favor of welded terminations, especially to Nickel-Metal Hydride cells. The prohibition against soldering directly to the cell to prevent heat damage to plastic seal components also applies.

BATTERY DESIGN

Nickel-Metal Hydride cells are versatile performers easily adapting to most application demands. Existing design libraries for Nickel Cadmium cells can usually be easily modified to incorporate Nickel-Metal Hydride cells instead. Economical off-the-shelf designs can be tailored to the specific voltage, space, and termination requirements of an application. Figure 20 illustrates a typical battery installation within a representative application, while Figure 21 diagrams many of the components recommended for a nickel-metal battery.

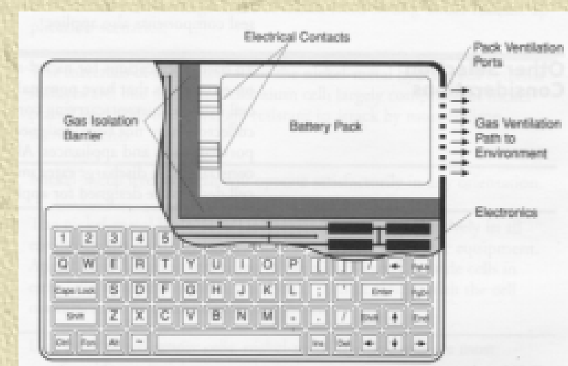


Figure 20.
Installation Within Typical Application (Notebook Computer)

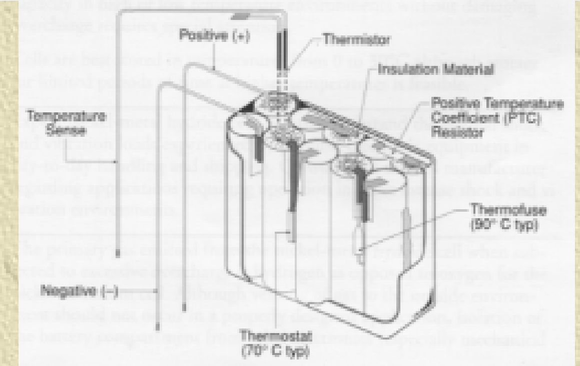


Figure 21.
Elements of Battery Assembly

Packaging Considerations
Nickel-Metal Hydride batteries are generally packaged in two forms:

- **Hard plastic cases** are recommended for applications requiring the end-user to handle the battery. These cases offer greater protection against handling damage and shock and vibrations stresses. But depending on the design, thermal management may be more difficult within the hard case. Injection molding of hard cases requires a substantial investment for mold construction and is thus best suited for high volumes.
- **Lighter shrink-wrapped plastic packaging** may be used when routine battery removal is not expected. These packs, as illustrated in Figure 21, usually consist of the cell assembly with insulators covering the exposed terminals. Plastic shrink tubing then covers the whole pack. Shrink-wrapped batteries have acceptable mechanical integrity for assembly, and when properly secured, withstand normal portable-product shock and vibration levels. Shrink packaging provides ample opportunity for hydrogen to diffuse and for internally generated heat to dissipate. Additional insulation from heat my be needed at the tangent points within the cell stacks (where they shrink material directly contacts the cell).

Either type of packaging must maintain adequate ventilation to the individual cells while providing room for cell interconnections, battery terminations, and requisite charge control sensors.

Shape
Battery shapes can be adjusted to fit application constraints. Among the most popular battery shapes are the following:

- Sticks—the terminal of one cells butts against the base of the next cell forming a long, slender battery.
- Linear—the cells are placed side by side in a straight line.
- Paired—cells are arranged in two (or more) symmetric rows.
- Nested—the cells of one row are nested within the indentations formed by the adjacent row.

Materials
Materials used in the assembly of Nickel-Metal Hydride batteries must withstand the high temperature environment that accompanies venting of the cell. Because of the exothermic nature of the charging process, should cells vent in overcharge, the vented gases will be largely high-temperature hydrogen (>200°C). Although these gases will quickly disperse and cool, all materials used in cell construction must be capable of withstanding elevated temperatures while remaining inert in a hydrogen environment. Recommended materials for use in Nickel-Metal Hydride battery construction include those below. Consult with the cell manufacturer regarding specific material specification details.

Wires: All wire insulation should be Teflon® , Kapton® , or other material with a minimum temperature rating of 200°C.

Sleeving: All shrink sleeving should be able to withstand 200°C. PVC sleeving is not generally recommended. Kraft paper or fishpaper sleeving should be approximately 0.007 inches thick.

Insulation: All cell insulation should be able to withstand 105°C for 24 hours. Vent shields must be constructed of Nomexâ or other insulating material capable of withstanding 210°C.

Case Material: Plastic cases must meet UL 94VO. Case materials without a rating of 210°C DTUL (Deflection Temperature Under Load) must be provided with vent shields over the positive ends of the cells.

Interconnections and Terminations

Cell interconnections typically consist of nickel (Ni 200) strip spot-welded from one cell terminal to the adjacent cell's case. Nickel bus strips offer good conductivity, ease of welding, and resistance to corrosion. Minimum recommended nickel strip size is 0.187 inches wide by 0.005 inches thick. Wire interconnections are rarely used because of the difficulty in attachment since soldering directly to cells is forbidden.

Battery terminations come in a variety of configurations ranging from simple flying leads (wires soldered to weld lugs which are then welded to the cells) in permanent installations to much more elaborate contact or connector systems on removable battery packs. Removable battery packs should be designed with a connection system that produces a minimum of 2 pounds of force while incorporating a wiping action on insertion to cut through oxide layers on the connection surfaces.

Other Components

Nickel-Metal Hydride batteries typically require more components than Nickel Cadmium batteries because of the emphasis on careful, redundant charge control including adequate fail-safe charge termination in case of excessive temperatures. These components include the following:

PTC Resistor: Positive temperature coefficient resistors such as Raychem's PolySwitch® circuit protector provide a latching, but resettable device for protection against short-circuit conditions.

Thermostat: Thermostats or other resettable thermal control devices are typically used for backup to the primary charge control system to guard against extended overcharge and the resulting elevated temperatures.

Thermal Fuse: Thermal fuses that open at a suitably elevated temperature (nominally 90°C) are often used as a third tier of thermal protection (after the normal charge control system and thermostat). They are a fail-safe measure since the battery charging system will become inoperative.

Thermistor: Thermistors are normally used for the temperature-sensing necessary for recommended charge control schemes.

Standard Configurations

A wide variety of standard battery configurations have been developed by cell manufacturers encompassing permutations of cell size/capacity, voltage, terminations, and charge control and termination sensors.

As a minimum, Moltech Power Systems, Inc. recommends that the following be included in any standard battery design:

- Primary Charge Control System—The standard temperature or time-based charge control system to switch to maintenance charging.
- Backup Resettable Thermal Protection—Terminates charging if the primary control system should fail to switch prior to extended overcharge. Normally set to 70°C.
- Fail-Safe Thermal Fuse—Permanently opens charge circuit if battery temperature exceeds acceptable limits. Normally set to 90°C.
- Short-Circuit Protection—Provides protection in cases of excess discharge current.
- Vents and Vent Shielding—Gas management system to diffuse and cool a vented stream of hydrogen.

Location

While battery location is generally influenced by product design constraints such as available space, influence on center of gravity, and ease of access, battery locations should also provide adequate ventilation, isolation from ignition sources and separation from major heat generators.

CARE AND HANDLING

Nickel-Metal Hydride cells should be handled in much the same manner as Nickel Cadmium cells. Major points are summarized below. Contact the cell manufacturer for additional information pertinent to specific applications.

General Safety Precautions

Nickel-Metal Hydride cells are generally well-behaved; however, like any rechargeable cell, they should be treated with care. Issues in dealing with Nickel-Metal Hydride cells include the following:

- Nickel-Metal Hydride cells operate on an exothermic, hydrogen-based charging and oxygen recombination process.
- Precautions should be taken to avoid venting. Should venting occur, the vent gases must be properly managed.
- Nickel metal hydride cells can generate high currents if shorted. These currents are sufficient to cause burns or ignition of flammable materials.
- They electrolyte is corrosive and capable of causing burns. For this reason, the cell should be maintained intact and sealed.

Shipping and Handling

Shipping and handling of Nickel-Metal Hydride cells is straightforward. The following suggestions ensure maximum performance, reliability, and safety in working with the cells:

- Ship cells only in the fully discharged state.
- Provide proper packaging, considering the cells' and batteries' weight, to avoid transit damage, either to cells or adjacent items.
- Do not store cells or batteries in loaded or shorted condition.
- Use product on a first-in, first-out inventory management policy.
- Avoid keeping excessive product in inventory.
- Avoid excessive handling of charged cells and batteries outside the end-use product.

Disposal

Although disposal procedures for Nickel-Metal Hydride cells are still evolving, as a minimum, observe the following precautions:

- Discharge fully prior to disposal.
- Do not incinerate.
- Do not open or puncture cells.
- Observe all national, state, and local rules and regulations for disposal of rechargeable cells.

Incoming Inspection

Normal incoming inspection techniques consist of physical examination of the cells for any dents, bulges, or leakage and selection of a representative sample for capacity testing. In general 100 percent capacity testing is discouraged because of the cost/schedule impact. Specialized incoming test procedures are normally developed for each application by consultation between the product designer and the cell manufacturer.

Back to Top

Contents

- Home
- Battery Information
- Cross Reference
- Product Safety Info
- Battery Disposal
- Glossary
- Comments
- Energizer Contacts
- References

- Energizer North America
- Energizer Europe

Contents

- Zinc Air

Flashlights

- Consumer
- Industrial
- Bulbs
- Active Index
- Discontinued Index

- **Home**
- **Battery Information**
- **Cross Reference**
- **Product Safety Info**
- **Battery Disposal**
- **Glossary**
- **Comments**
- **Energizer Contacts**
- **References**

- **Energizer North America**
- **Energizer Europe**

Contents

- **Glossary**
- **Comments**
- **Energizer Contacts**
- **References**

- **Energizer North America**
- **Energizer Europe**

Contents

- Comments
- Energizer Contacts
- References

- Energizer North America
- Energizer Europe

Contents

Discontinued Index

- Home
- Battery Information
- Cross Reference
- Product Safety Info
- Battery Disposal
- Glossary
- Comments
- Energizer Contacts
- References

- Energizer North America
- Energizer Europe

Eveready Battery Company, Inc.
25225 Detroit Road
(P.O. Box 450777)
Westlake, Ohio 44145

DISPOSAL OF *Eveready/Energizer* CARBON ZINC AND STANDARD ALKALINE BATTERIES

Energizer carbon zinc and standard alkaline batteries are United States Resource Conservation and Recovery Act (RCRA) non-hazardous waste.

Waste carbon zinc and standard alkaline batteries meet the United States Federal definition of a solid waste per 40 Code of Federal Regulations (CFR) 261.2. As such, the generator must make certain determinations relative to the waste material. Waste carbon zinc and standard alkaline batteries do not fall under any of the specific United States Federal RCRA F, K, P or U lists.

This leads us to the RCRA characteristic waste criteria. Some Toxicity Characteristic Leaching Procedure (TCLP) listed materials may be present in minute quantities in the raw materials, but are well below the established regulatory maximum values. Waste carbon zinc and standard alkaline batteries are not RCRA toxic. Only the characteristics of ignitability, corrosivity and reactivity remain as possible classifications.

The batteries are solid, not liquid, which precludes their being a corrosive waste, since corrosive waste must be liquid by definition. As an inert solid, flash point is not an appropriate test for ignitability. Our batteries are a safe consumer product and, under standard temperature and pressure conditions, will not cause fire through friction, absorption of moisture, or spontaneous chemical changes. The batteries contain no sulfides or cyanides, and they do not meet any other reactivity criteria.

United States Federal hazardous waste regulations are specific about relating waste determination to the waste ***as generated***. As generated, scrap carbon zinc and standard alkaline batteries are <u>not</u> a specifically listed waste stream and they do <u>not</u> meet the criteria for ignitable, corrosive, reactive or toxic wastes. Scrap carbon zinc and standard alkaline batteries are <u>not</u> hazardous waste and they are <u>not</u> regulated by the United States Department of Transportation (DOT) as hazardous materials.

Other nations and some US states may regulate waste based on additional criteria or different test protocols. The status of scrap carbon zinc and standard alkaline batteries should be confirmed in the nation or US state(s) where disposal occurs.

Energizer
January, 2002

Eveready Flashlights

HOME

Model Number	Picture	Qty/ Battery Size	Bulb Type	Weight (g)*	Length (mm)	Width (mm)	Height (mm)
3251		2 / D	PR2	61	185.2	52.3	N.A.
4212		2 / AAAA	222	21	66.5	14.0	22.3
4251		2 / D	KPR102	99	192.0	60.7	N.A.
5109		6 Volt Lantern	PR13	220	183	99	117

*** Weight without batteries**

Contents

Discontinued Index

- **Home**
- **Battery Information**
- **Cross Reference**
- **Product Safety Info**
- **Battery Disposal**
- **Glossary**
- **Comments**
- **Energizer Contacts**
- **References**

- **Energizer North America**
- **Energizer Europe**
