File: 357BatteryData.pdf
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Author: Tim Hughes
Email: TimHughes@ieee.org

This document contains Anotated Technical Data on the "357" EverReady (Energizer) , Silver Oxide Batteries , which are high current capable cells, in an IEC size SR44 case.

Data Sheets from different production times, as well as other vendors data sheets are included. Data on replacements for the 357 cell (which ceased production few years ago) from EverReady are also included.

In addition for comparison, various other model AgO cells in the SR44 case size, are included.

Battery impedance data for the original 357 , is derived and plotted. This is based on the most detailed discharge curves supplied in the original 357 data sheets.

T.Hughes

From mathcad File: 357Capacity.mcd ver 1.0
(c) T.Hughes 2006/2007

This file discusses Silver Oxide type 357 battery characteristics. (SR44 size)
It calculates and plots "typical" battery impedance data from discharge curves originally published for the high current 357 EverReady (Potassium Hydroxide Electrolyte) silver oxide battery, in the Union Carbide (EverReady brand) Battery databook. This data book which has been out of print for many years, contained the most comprehensive data for the 357 ever published.

The 357 specs changed over the years and Everready no longer makes the 357.

The current EverReady replacements,for the 357 are known as the "357/303" and also "357/303H" (higher current), these have characteristics between that of the of the original low current (NaOH) 303, and the 357.

Even the "H" version appears a bit less capable for high current applications. The original 357 was specified at a wrist temperature (LED wrist watch usage) of 35 degC, unlike most cells today, which are rated at ~21 deg C.

Keep in mind that running at 35 deg C gives slightly improved performance, as the cell impedance is a bit less at 35C, than it would be at room temperature. Later versions of the battery and revisions of the data sheet for the 357, were specified at room temperature (21C).

EverReady originally made a number of cells in the same SR44 case size as the 357, including the 303, but the 357 had the flattest discharge curve with the highest current capability, making it most suitable for Olympus OM SLR cameras and similar devices.

Rated Capacity:

From original 357 Data Sheet :
Energizer 357 with 6500Ohms constant load <u>@35C</u>

at 1.54V 725hrs
at 1.50V 780hrs or ~185 mAh
at 1.45V 800hrs
at 1.3V 810hrs or ~ 192 mAh
at 0.8V 820hrs

Original 357 spec was tested at 35C ("wrist temperature")

$$\frac{1.54 \cdot V}{6500 \cdot ohm} = 0.237\,mA$$

Approx mAhr:

$$\frac{1.54 \cdot V \cdot 780 \cdot hr}{6500 \cdot ohm} = 184.8\,mA \cdot hr$$

$$\frac{1.54 \cdot V \cdot 810 \cdot hr}{6500 \cdot ohm} = 191.908\,mA \cdot hr$$

Here we setup and enter the discharge curve data from the original 357 data sheet:

Set index for data array: $i := 0 .. 19$

$$Dat := \begin{pmatrix} 0 & 1.565 & 1.55 & 1.41 \\ 2 & 1.55 & 1.54 & 1.4 \\ 5 & 1.55 & 1.53 & 1.38 \\ 10 & 1.55 & 1.525 & 1.365 \\ 15 & 1.55 & 1.52 & 1.37 \\ 20 & 1.55 & 1.518 & 1.39 \\ 25 & 1.55 & 1.517 & 1.394 \\ 30 & 1.55 & 1.516 & 1.393 \\ 35 & 1.55 & 1.515 & 1.392 \\ 40 & 1.55 & 1.514 & 1.39 \\ 60 & 1.55 & 1.508 & 1.37 \\ 80 & 1.55 & 1.5 & 1.35 \\ 100 & 1.55 & 1.495 & 1.326 \\ 120 & 1.55 & 1.49 & 1.311 \\ 145 & 1.55 & 1.484 & 1.3 \\ 150 & 1.55 & 1.48 & 1.295 \\ 160 & 1.55 & 1.468 & 1.277 \\ 170 & 1.55 & 1.445 & 1.23 \\ 175 & 1.55 & 1.43 & 1.19 \\ 180 & 1.55 & 1.41 & 1.15 \end{pmatrix}$$

Extract data into named arrays for plotting:

$Capacity_i := Dat_{i,0}$ in mAh

Voltages @ loads of 30 Ohms, 100 Ohms and 92kOhms

Voltage with continuous **92k** Ohm (16uA) load:

$V92k_i := Dat_{i,1}$

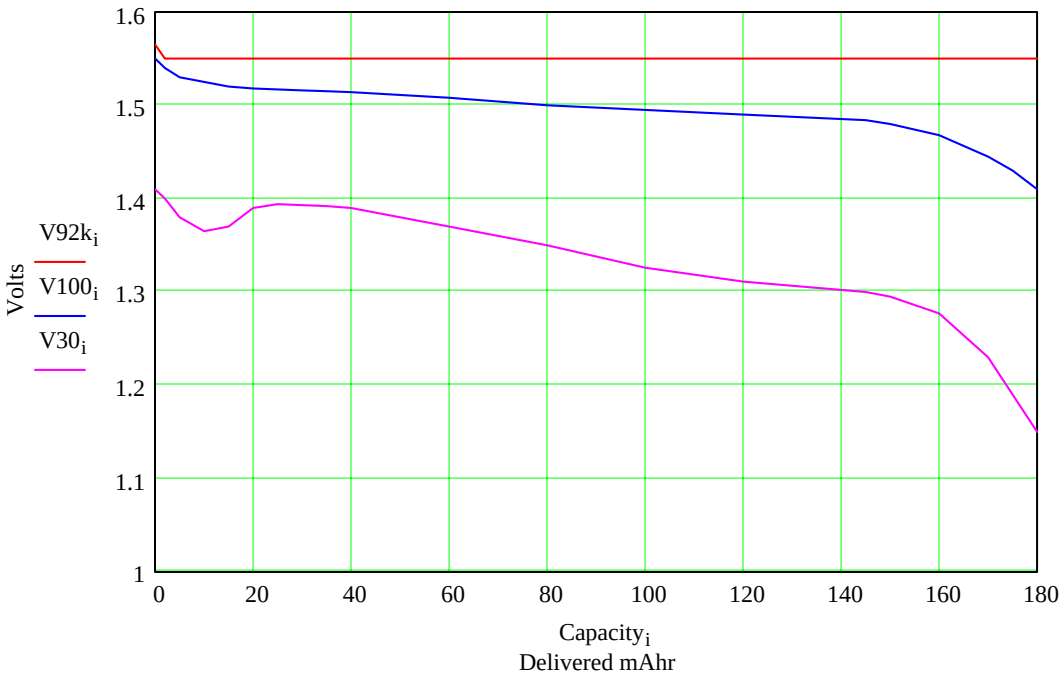
100 ohm pulsed load on top of 16uA load:

$V100_i := Dat_{i,2}$

30 ohm pulsed load on top of 16uA:

$V30_i := Dat_{i,3}$

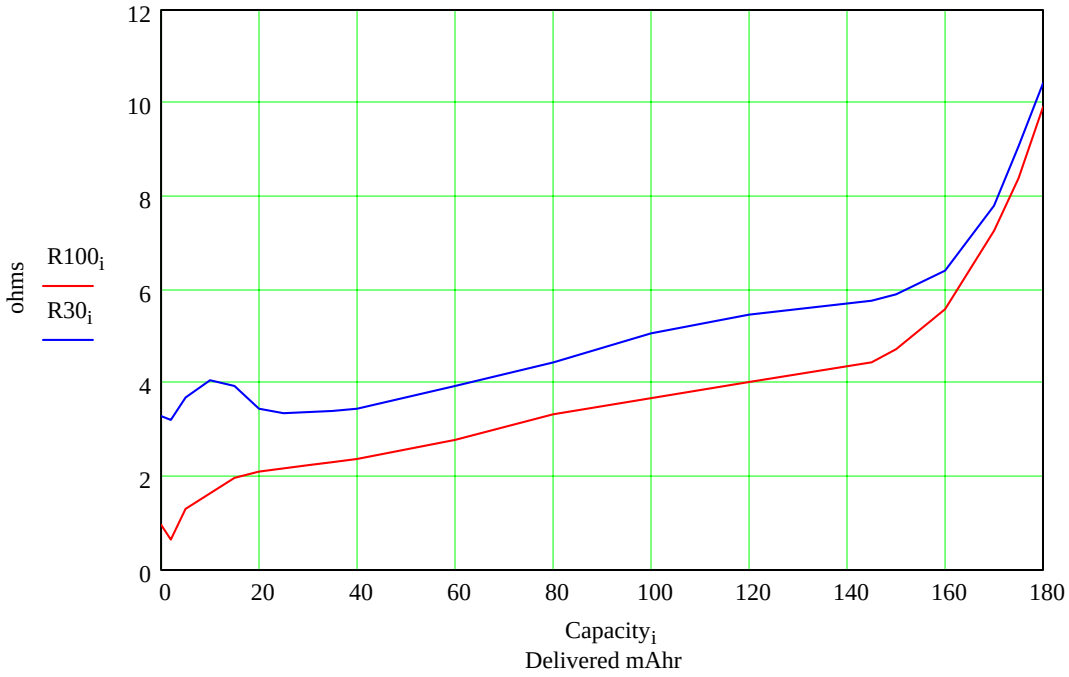
Plot Battery voltages at end of various pulse loads during a 16uA slow discharge (92k Ohm Continuous load,100 Ohm, 30 Ohm pulse loads, based on the original 357 published data sheet:



Combine slow 16uA continuous background discharge (92k Ohm load) data , with pulse data.
We Calculate **Battery "DC" Impedance** at pulse loads of
30 ohms (tested for 2sec, 24 times per day) , (~47mA pulse)
100 ohms (tested for 2sec, 12 times per day) (~15mA pulse ,
(15mA is similar to to load from OM camera shutter):

$$R100_i := \frac{\left(V92k_i - V100_i\right)}{\left(\frac{V100_i}{100}\right)} \qquad R30_i := \frac{\left(V92k_i - V30_i\right)}{\left(\frac{V30_i}{30}\right)}$$

"DC" Battery 2sec Pulse Impedance at 30 ohm load (Blue curve) and 100 ohm load (Red) with 16uA background current, tested at at 35C (calc based on original data sheet voltages):



Internal Resistance: From **Guaranteed Spec** (from original data sheet) :
>1.2V at 100 Ohm, 0.1sec to 2sec pulse, this translates to ~ **29 Ohm** :

$$\frac{(1.55V - 1.2V)}{\left(\frac{1.2V}{100ohm}\right)} = 29.167\,\Omega$$

note the last (2004), 357 battery data sheet, guaranteed a lower max value of ~**19 Ohm**

Note this spec is considerably higher than the graph, even at end of discharge.

After sitting on the shelf for ~2yrs at 20C , depending on the vendor the battery impedance may rise into the ~20 Ohms region at partial discharge, which may explain this higher max "guaranteed" impedance spec than the typical values shown in these curves.

Last (**3/29/2004**) data sheet available for Energizer 357 has this guaranteed worst case spec:
100 Ohm 2 Sec load >1.3V at **21C** This translates to ~**19 Ohms**

It also has:
0% discharge typ spec @100 Ohms, 5sec :1.55V (~50/15 very approx 3 Ohm) cf ~2 Ohm above
40% discharge typ spec @100 Ohms,5sec :1.40V (~150/14 = 10.8 Ohm) cf ~3 Ohm "
80% discharge typ spec @100 Ohms,5sec :1.34V (~210/13.4 = 15.67 Ohm) cf ~4.2 Ohm "

(**8/25/2006**) Energizer 303/357H spec for impedance :
2 - 8 Ohm at 40Hz @ 21C
(note 40Hz spec is not as tough a test as 2sec pulse test of original 357 data book)

Sony SR44W (KOH) has a rating of 180mAh @ 4.7K load,
540hrs @ 23C,
525hrs @ 50C,
470hrs @ -10C
(note : SR44SW is NaOH cell)

Other vendors part numbers for SR44 size cells (beware of LR44 Alkaline "replacements, which are not suitable replacements in most applications):

7228, 1131SO, 10L14, J, D357H, G13, RW42, S76E, SR44W, V357 10L14, 228, 280-62, 357, D357, D357H, EPX76, G13, GP57, GPS76E, HS-C, J, KS76, LR44H, M02, MR44, MS76, NP-313, NP313, S05, S1154, S76, S76E, SB-B9, SG13, SP357, SR1154, SR44, SR44W, V313, V357, V76PX

Other names listed on web :

Renata 303 UCAR 303 Maxell SR44SW Panasonic SR44SW Sony SR44SW Toshiba SR44SW Varta V303 Rayovac 303 Timex A Citizen 280-08 Seiko SB-A9 I.E.C. SR44 I.E.C. SR1154

"EVEREADY" NO. 357 CELL

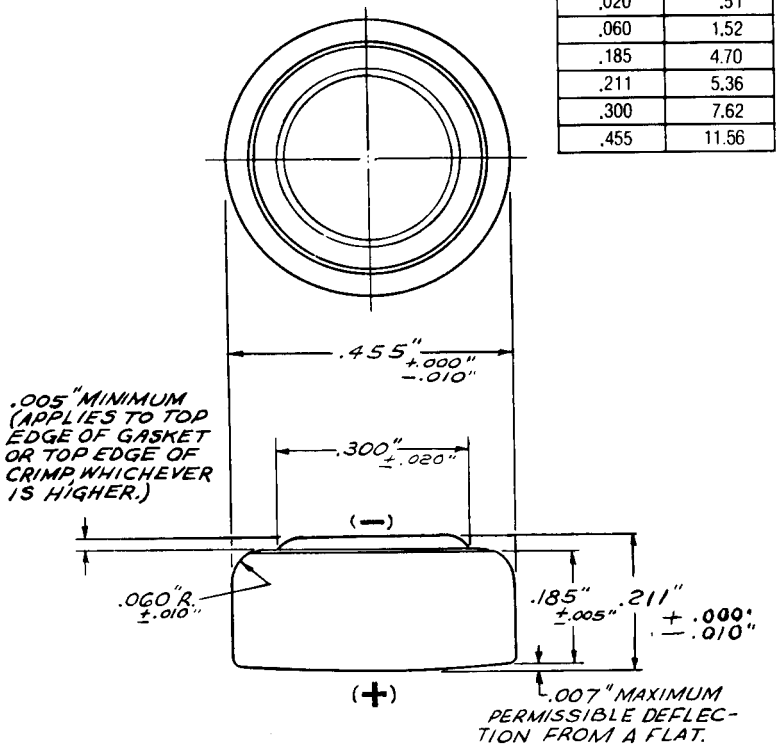
Original 357 DataSheet From EverReady (Union Carbide) Battery Databook T.H.

Type: Silver Oxide

Designations: ANSI-WS15, IEC-SR44

THIS BATTERY IS DESIGNED FOR USE ON CONTINUOUS LOW DRAIN—HIGH PULSE DRAIN ON DEMAND.

Inches	Millimeters
.005	.13
.007	.18
.010	.25
.020	.51
.060	1.52
.185	4.70
.211	5.36
.300	7.62
.455	11.56



SPECIFICATIONS

Voltage Taps ..... —, +1.5

Average Service Capacity (to 1.3 volts) ..... 190 milliampere-hours
(Rated capacity at 6,500 ohm load at 35°C)

Terminals ..... Flat Contacts

Average Weight ..... 0.080 oz. (2.27 grams)

Volume ..... 0.029 cubic inch (0.48 cubic centimeter)

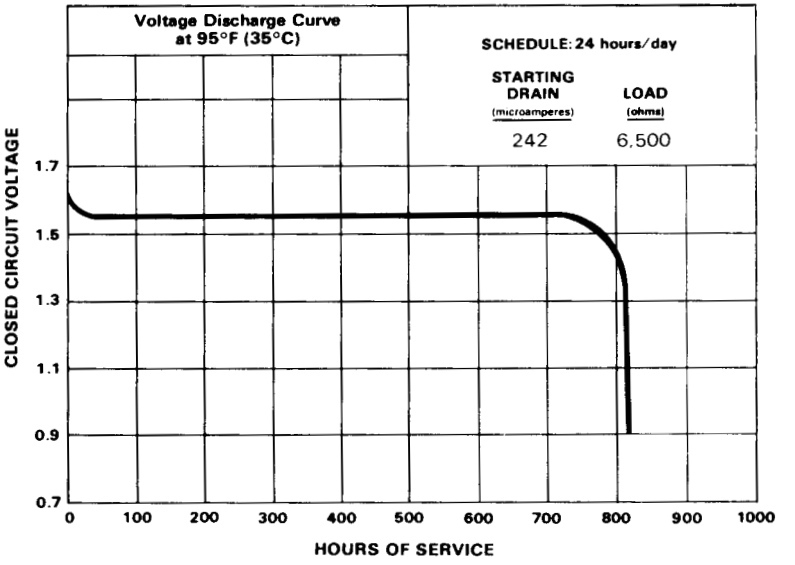
Cell ..... One No. 6-45202

For service information see reverse side of this sheet

"EVEREADY" NO. 357

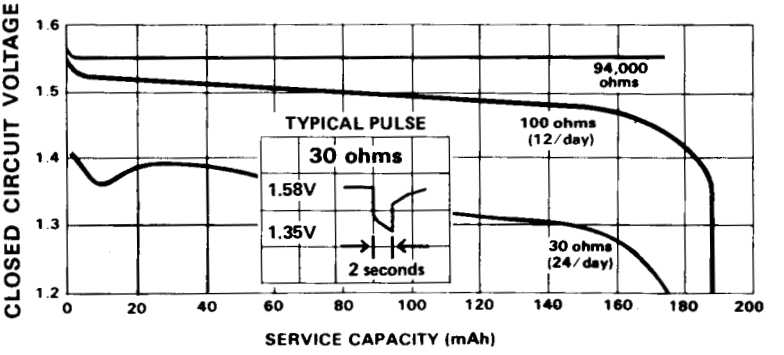
Estimated Service at 95°F (35°C)

SCHEDULE	STARTING DRAIN (microamperes)	LOAD (ohms)	CUTOFF VOLTAGE 0.9V	1.3V
24 hours/day	242	6,500	820 hours	810 hours



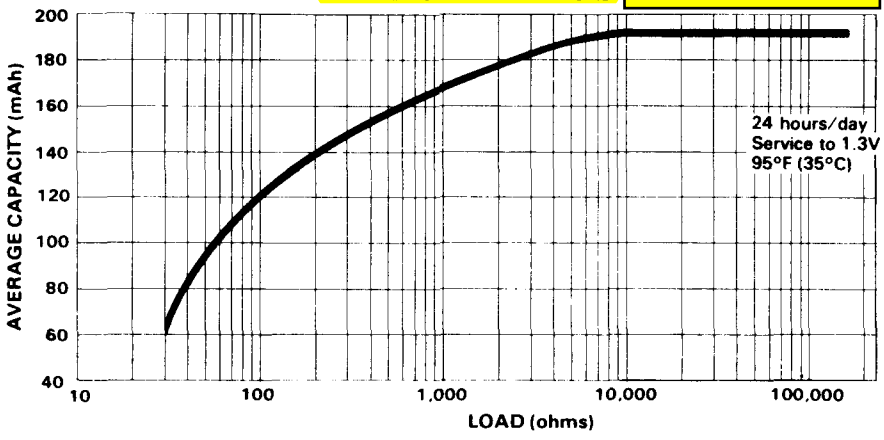
Average Performance Data at 95°F (35°C)

Background: 94,000 ohms continuous (IC simulated load 16.8 microamperes)
Pulse Width: 2 seconds
Pulse Frequency: 30 ohms @ 24/day (LED simulation)



"EVEREADY" NO. 357

AVERAGE CAPACITY VS. LOAD (continuous discharge)



Estimated Service Capacity vs. Pulsed Load [at 95°F (35°C)]

PULSE LOAD	PULSE	PULSES PER DAY	SERVICE CAPACITY TO 0.9v	SERVICE CAPACITY TO 1.2v
150 ohms	2 seconds/hour	24		190 mAh
100	2 seconds/hour	12		185
50	2 seconds/hour	24		180
30	2 seconds/hour	24	185 mAh	175
20	2 seconds/hour	24	175	125
10	2 seconds/hour	24	120	15
150	2 seconds/10 minutes	144	190	
100	2 seconds/10 minutes	144	190	
50	2 seconds/10 minutes	144	180	
30	2 seconds/10 minutes	144	180	100
20	2 seconds/10 minutes	144	160	50
10	2 seconds/10 minutes	144	100	0

INTERNAL RESISTANCE

Closed circuit voltage no less than ..... **1.2 volts**

On a load of ..... **100 ohms**
for 0.1 to 2 seconds

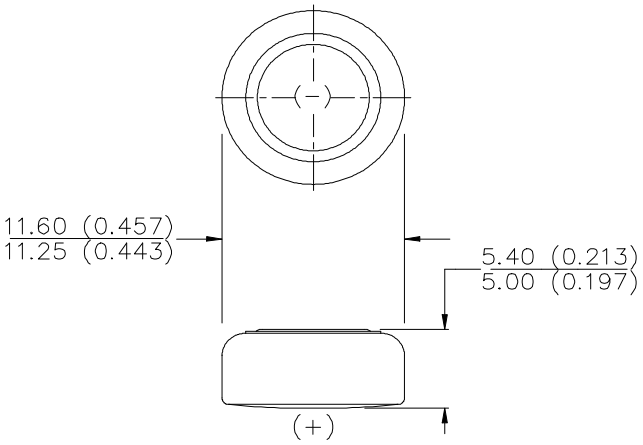
Energizer **ENGINEERING DATASHEET**

EVEREADY BATTERY CO. 1-800-383-7323 / USA
Internet: www.energizer.com 1-800-383-7323 / CANADA
+ 44 (0) 208 920 2306 / EUROPE

2004 data sheet TH

ENERGIZER NO. 357

Industry Standard Dimensions in mm (inches)

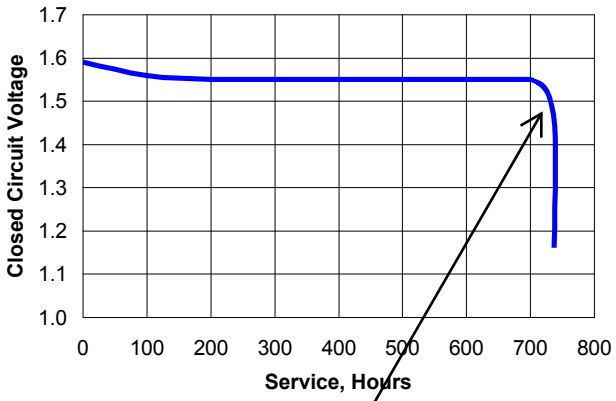


Chemical System: Silver Oxide (Zn/Ag_2O)

Designation: ANSI / NEDA-1131SO, IEC-SR44
Battery Voltage: 1.55 Volts
Average Weight: 2.3 grams (0.08 oz.)
Volume: 0.57 cubic centimeters (0.035 cubic inch)
Average Capacity: 175 mAh to 1.3 volts
(Rated at 6.5k ohms continuous at 21ºC)

~0.238mA load TH

TYPICAL DISCHARGE CURVE
Simulated Test @ 21ºC (70ºF)



Note ~725h @ 1.5V cutOff
= **~165mAh @ 0.24mA**

DESIGNED FOR USE ON CONTINUOUS LOW DRAIN
HIGH PULSE ON DEMAND

Simulated Application Test
Estimated Average Service at 21ºC (70ºF)

Schedule:	Typical Drains at 1.55V (milliamperes)	Load (ohms)	Cutoff Voltage 1.3V
24 hours/day	0.238	6,500	734 Hours

INTERNAL RESISTANCE: Closed circuit voltage no less than 1.30 volts on a load of 100 ohms at 21ºC (70ºF) for 0.1 to 2.0 seconds.

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

Guaranteed DC Impedance < 19.2 Ohm
Actual Typical Impedance lower (see below) TH

Depth of Discharge as Percent of Rated Capacity

Temperature	0%	40%	80%
21ºC (70ºF)	1.55V	1.40V	1.34V
-10ºC (14ºF)	1.35V	1.06V	0.90V

Typical Impedance:
@ 0% discharge : 3 Ohm
(approx)
@40% discharge : 10.7 Ohm
@80% discharge : 15.7 Ohm
TH

Important Notice

This data sheet contains information specific to batteries manufactured at the time of its publicati

Contents herein do not constitute a warranty.

Energizer
1-800-383-7323 USA/CAN
www.energizer.com

ENERGIZER 357/303H

2004 Data Sheet TH
note type 357/303H is
different from 357/303

SILVER OXIDE

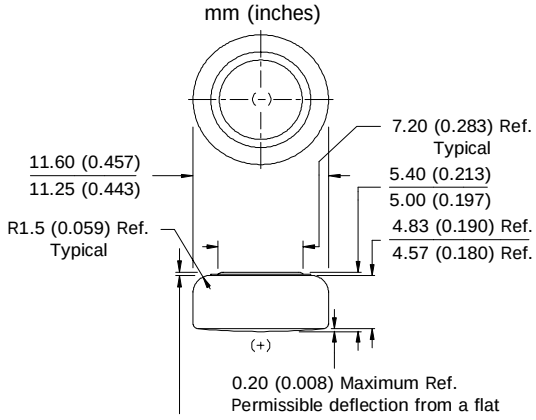
Specifications

Chemical System:	Silver Oxide (Zn/Ag_2O)
Designation:	ANSI-1131SO, IEC-SR44
Nominal Voltage:	1.55 Volts
Typical Capacity:	175 mAh* (to 1.3 volts)
Capacity Test:	6.5K ohm continuous drain at 21°C
Typical Weight:	2.3 grams (0.08 oz.)
Typical Volume:	0.57 cubic centimeters (0.035 cubic inch)
Impedance (40 Hz):	2 to 8 ohms

* Varies according to the applied load, temperature, and cutoff voltage.

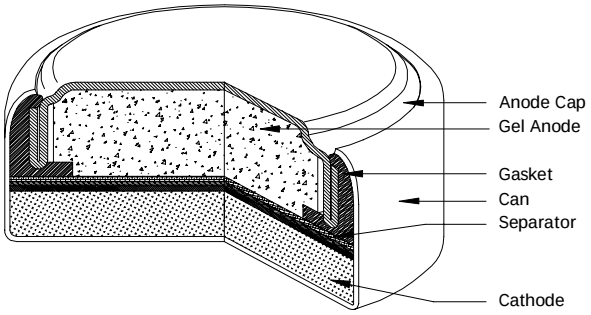
Industry Standard Dimensions

mm (inches)



DESIGNED FOR USE ON CONTINUOUS LOW DRAIN
HIGH PULSE ON DEMAND

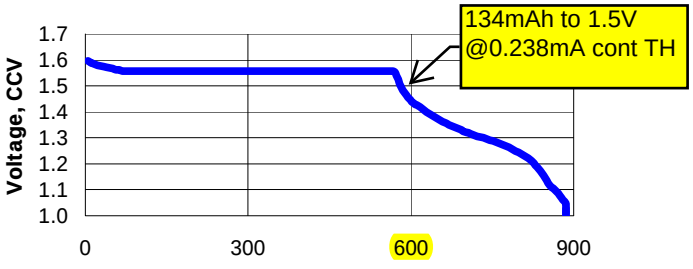
Cross Section



Typical Discharge Characteristics

Typical Performance at 21°C (70°F)

Schedule: Continuous
Typical Drain @1.55V:
0.238 milliamperes
Load: 6.5K ohm

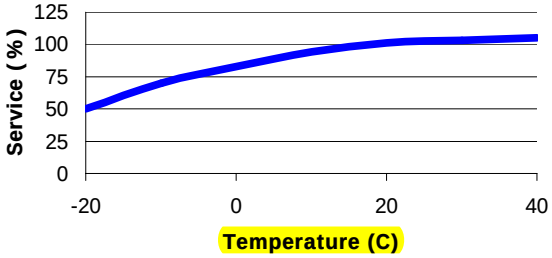


Schedule	Typical Drains at 1.55V (milliamperes)	Load (ohm)	Cutoff 1.3V (hours)
Continuous	0.238	6.5K	734

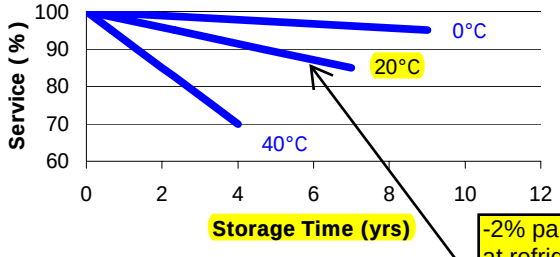
Temperature Characteristics

Typical Performance at Low Discharge Rates

Service Effects



Storage Effects



-2% pa @ 20C, but
at refrigerator temp (6C)
about -10% in 10yrs

Important Notice

This datasheet contains typical information specific to products manufactured at the time of its publication.

PRODUCT DATASHEET

Energizer

1-800-383-7323 USA/CAN
www.energizer.com

note 357/303 is different from 357/303H TH

ENERGIZER 357/303

SILVER OXIDE

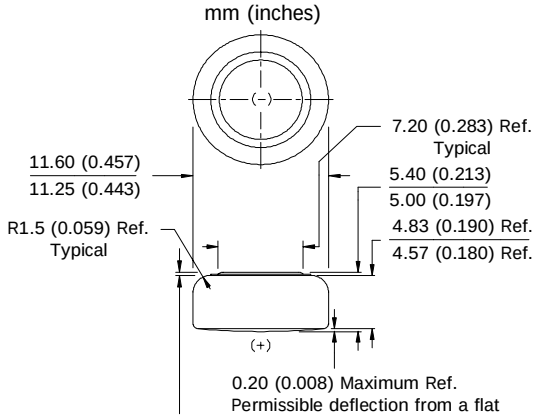
Specifications

Chemical System:	Silver Oxide (Zn/Ag_2O)
Designation:	ANSI-1131SO, IEC-SR44
Nominal Voltage:	1.55 Volts
Typical Capacity:	150 mAh* (to 1.3 volts)
Capacity Test:	6.5K ohm continuous drain at 21°C
Typical Weight:	2.3 grams (0.08 oz.)
Typical Volume:	0.57 cubic centimeters (0.035 cubic inch)
Impedance (40 Hz):	2 to 8 ohms

* Varies according to the applied load, temperature, and cutoff voltage.

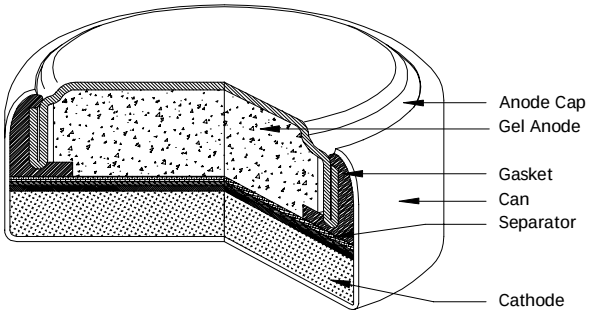
Industry Standard Dimensions

mm (inches)



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

Cross Section

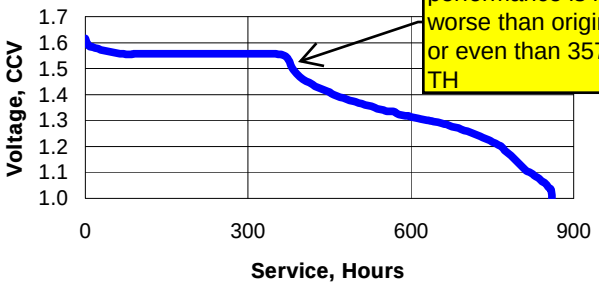


Typical Discharge Characteristics

Typical Performance at 21°C (70°F)

Schedule: Continuous
Typical Drain @1.55V: 0.238 milliamperes
Load: 6.5K ohm

91mAh to 1.5V. This performance is much worse than original 357 or even than 357/303H TH

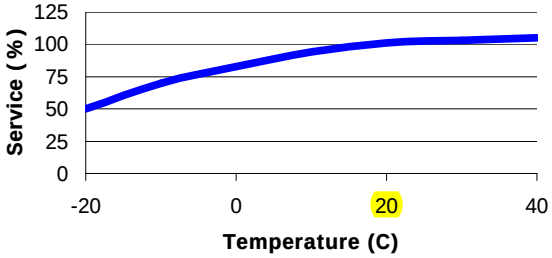


Schedule	Typical Drains at 1.55V (milliamperes)	Load (ohm)	Cutoff 1.3V (hours)
Continuous	0.238	6.5K	630

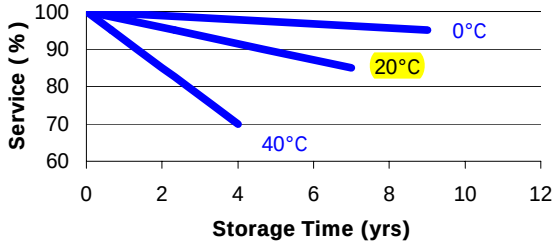
Temperature Characteristics

Typical Performance at Low Discharge Rates

Service Effects



Storage Effects



Important Notice

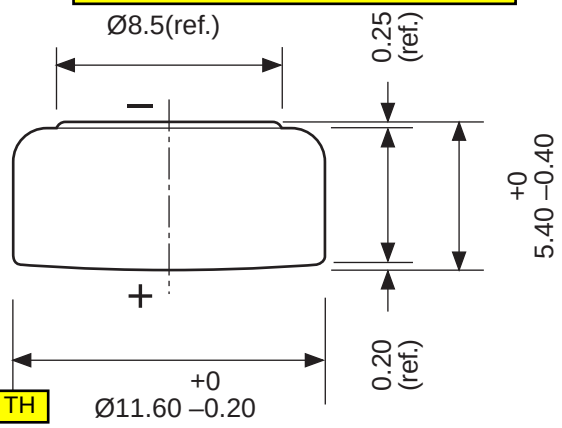
This datasheet contains typical information specific to products manufactured at the time of its publication.

GP Batteries

Data Sheet ***Model No.: GP357***

Description	:	Silver Oxide High Drain Button Cell
Nominal Voltage	:	1.55 Volts
Nominal Dimensions	:	Ø11.60 X 5.40mm
Applications	:	Calculator, Hearing aid, lighter, electronic toy, camera, etc.
Average Weight	:	2.3g
Shelf Life	:	Not less than 90% of the service capacity, following 1st year storage at 20°C.
Date Code	:	Unless otherwise specified, each cell will carry a numeric year code and an alphabetical month code.
Nominal Service Life (to 1.2V at 20°C)	:	165 hrs (at 1.5kΩ Load) 230 days (at 50kΩ Load)

"Typical" claimed value is -2% pa for Everready 357/303 compared with "guaranteed" -10% pa for GP here TH



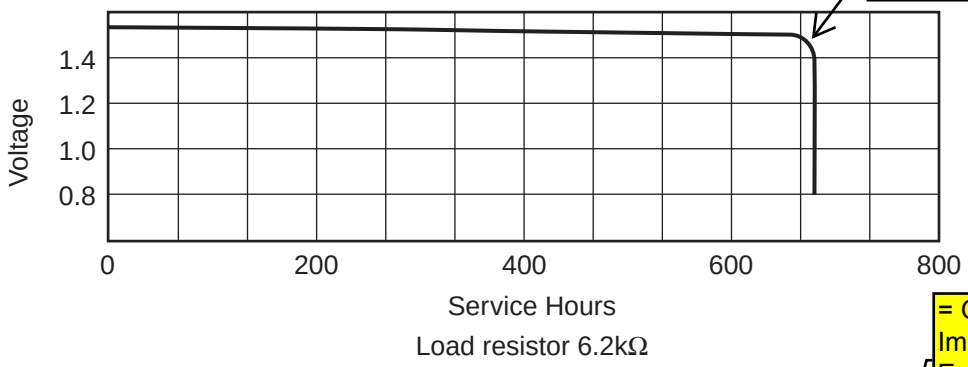
~165mAh @ 1mA TH

~165mAh @ 31uA TH

Unit : mm

Typical Discharge Characteristics at 20°C

~634hrs to 1.5V @ 0.238mA ~150mAh TH



= Guaranteed DC Impedance < 19.2 Ohm Expect actual Impedance lower TH

Average Service Capacity:
165 mAh (rated capacity at 6.2kΩ load, cut off voltage 1.2V at 20°C)

~ 150mAh to 1.5V (see note above)

Close circuit voltage:
1.30 Volts (min.) (load resistor 100Ω at 20°C for 1 to 2 seconds)

Cross Reference:

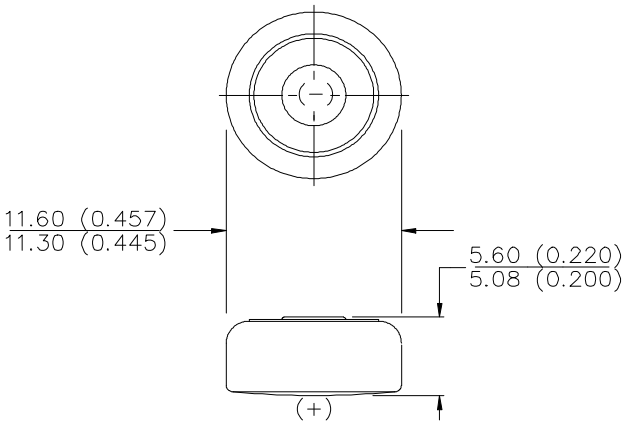
IEC	JIS	EVEREADY	VARTA	DURACELL	PANASONIC	SONY
SR44	SR44	357	V357	D357	SP357	SR44SW

Energizer ENGINEERING DATASHEET

EVEREADY BATTERY CO.
Internet: www.energizer.com
1-800-383-7323 / USA
1-800-383-7323 / CANADA
+ 44 (0) 208 920 2306 / EUROPE

ENERGIZER NO. 303

Industry Standard Dimensions in mm (inches)

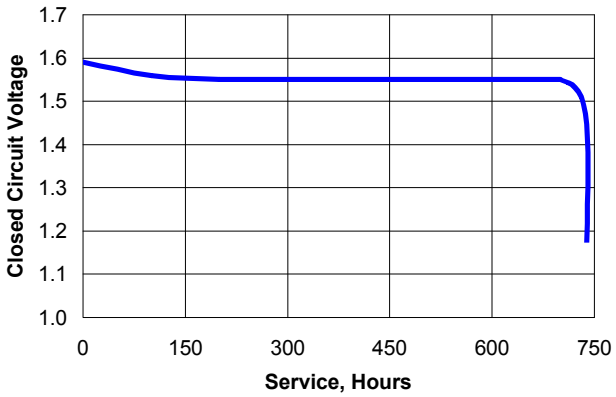


Chemical System: Silver Oxide (Zn/Ag_2O)

Battery Voltage: 1.55 Volts
Average Weight: 2.6 grams (0.09 oz.)
Volume: 0.59 cubic centimeters (0.36 cubic inch)
Average Capacity: 175 mAh to 1.3 volts
(Rated at 6.5k ohms continuous at 21ºC)

DESIGNED FOR USE ON CONTINUOUS LOW DRAIN

TYPICAL DISCHARGE CURVE
Simulated Test @ 21ºC (70ºF)



Simulated Application Test
Estimated Average Service at 21ºC (70ºF)

Schedule:	Typical Drains at 1.55V (milliamperes)	Load (ohms)	Cutoff Voltage 1.3V
24 hours/day	0.238	6,500	734 Hours

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

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

= Guaranteed Internal resistance <63 Ohm TH

Depth of Discharge as Percent of Rated Capacity

Temperature	0%	40%	80%
21ºC (70ºF)	1.58V	1.55V	1.55V
-10ºC (14ºF)	1.50V	1.50V	1.50V

Important Notice

This data sheet contains information specific to batteries manufactured at the time of its publication.
Contents herein do not constitute a warranty.

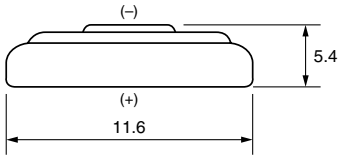
Data Sheet

Zinc Silver Oxide Battery

SR44W

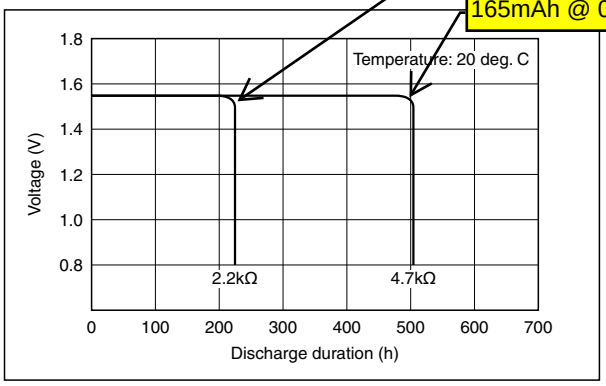
maxell

Model	SR44W	
System	Zinc-Silver oxide/Alkaline Electrolyte	
Nominal Voltage (V)	1.55	
Nominal Capacity (mAh)*	165	
Nominal Discharge Current (μA)	200	
Temperature Ranges (deg. C)	**min.**	**max.**
Operating	–10	+60
Weight (g)	2.2	
Dimensions (mm)		
Diameter	11.6	
Height	5.4	

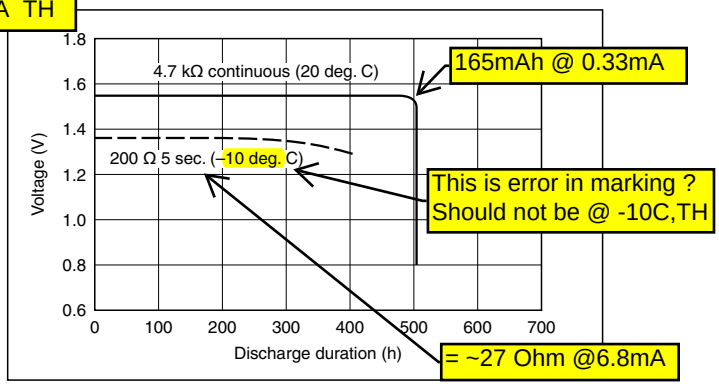


Characteristics

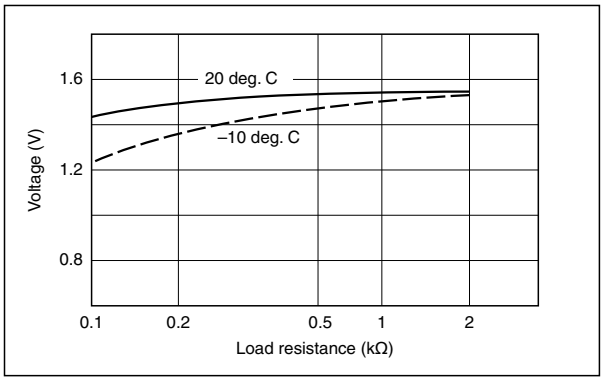
Discharge Characteristics



Pulse Discharge Characteristics



Temperature Characteristics



* Nominal capacity indicates duration until the voltage drops down to 1.2V when discharged at a nominal discharge current at 20 deg. C.

Hitachi Maxell, Ltd.
2-18-2, Iidabashi, Chiyoda-ku, Tokyo 102-8521, Japan
http://www.maxell.com

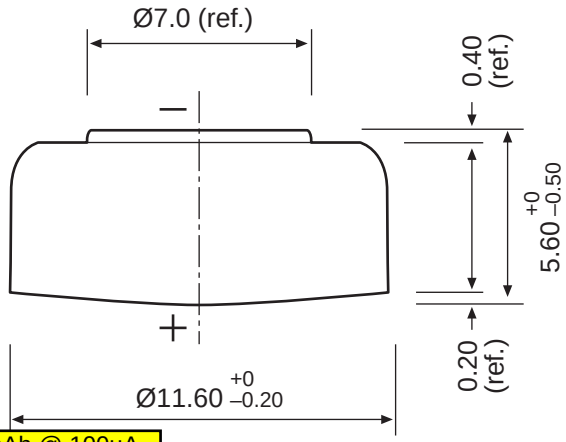
- **Data and dimensions are just reference values. For further details, please contact us at your nearest Maxell office.**
- **Contents on this website are subject to change without notice.**

Date of issue: April, 2007

GP Batteries

Data Sheet ***Model No.: GP303***

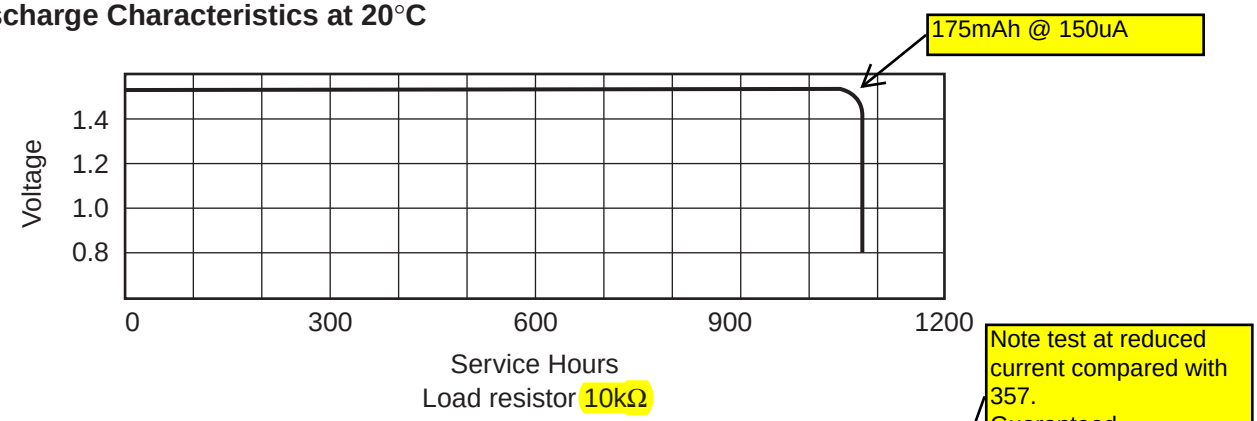
Description	:	Silver Oxide Low Drain Button Cell
Nominal Voltage	:	1.55 Volts
Nominal Dimensions	:	Ø11.60 X 5.60mm
Applications	:	Watch (with alarm and lamp), calculator, electronic toy, etc.
Average Weight	:	2.5g
Shelf Life	:	Not less than 90% of the service capacity, following 1st year storage at 20°C
Date Code	:	Unless otherwise specified, each cell will carry a numeric year code and an alphabetical month code.
Nominal Service Life (to 1.2V at 20°C)	:	1650 hrs (15kΩ Load)
		230 days (50kΩ Load)



170mAh @ 100uA

171mAh @ 31uA

Typical Discharge Characteristics at 20°C



Average Service Capacity:
165 mAh (rated capacity at 10kΩ load, cut off voltage 1.2V at 20°C)

Close circuit voltage:
1.30 Volts (min.) (load resistor 200Ω at 20°C for 1 to 2 seconds)

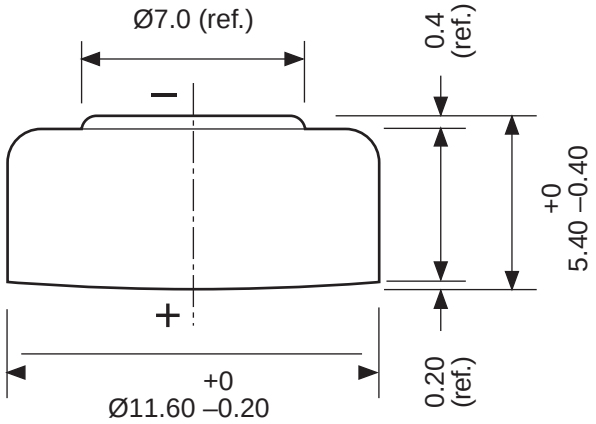
Cross Reference:

IEC	JIS	EVEREADY	VARTA	DURACELL	PANASONIC	SONY
SR44	SR44	303	V303	D303	SP303	SR44SW

GP Batteries

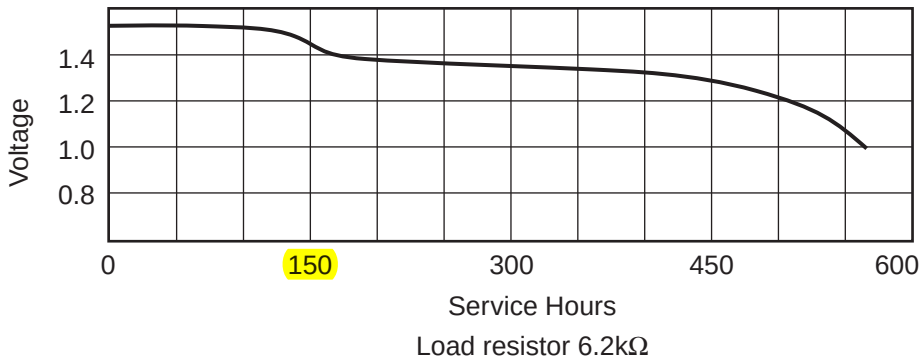
Data Sheet ***Model No.: GPS76E***

Description	:	Silver Oxide High Drain Button Cell
Nominal Voltage	:	1.55 Volts
Nominal Dimensions	:	Ø11.60 X 5.40mm
Applications	:	Calculator, hearing aid, lighter, electronic toy, camera, etc.
Average Weight	:	2.1g
Shelf Life	:	Not less than 90% of the service capacity, following 1st year storage at 20°C
Date Code	:	Unless otherwise specified, each cell will carry a numeric year code and an alphabetical month code.
Nominal Service Life (to 1.2V at 20°C)	:	280 hrs (3kΩ Load) 190 days (50kΩ Load)



Unit : mm

Typical Discharge Charateristics at 20°C



Load resistor 6.2kΩ

Average Service Capacity:
130 mAh (rated capacity at 6.2kΩ load, cut off voltage 1.0V at 20°C)

= Impedance Guaranteed < 19 Ohm

Close circuit voltage:
1.30 Volts (min.) (load resistor 100Ω at 20°C for 1 to 2 seconds)

Cross Reference:

IEC	JIS	EVEREADY	VARTA	DURACELL	RAYOVAC	SONY
SR44	SR44	S76E	V76PX	MS76	RS76	SR44SW

357

SR1154W (SR44)
Watch Battery
Swiss Made

Technical Data Sheet

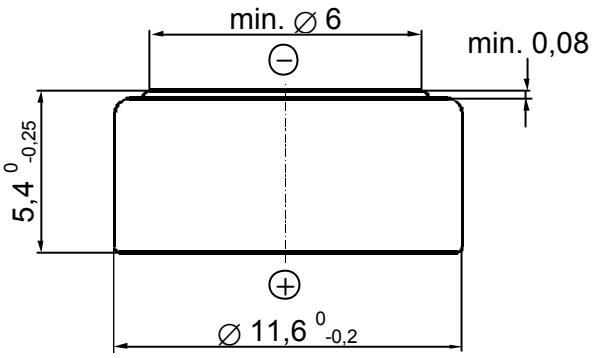
Specifications

Chemical system	Zinc / Monovalent Silver Oxide, high drain
Nominal Voltage	1,55 V
Capacity	190 mAh, Discharge over 8,25 kΩ at 25°C to 1,2 V
Operating Temperature	0°C – 60°C
Self Discharge	Less than 10% per year at 20°C
Weight	~2,30 g

Dimensions

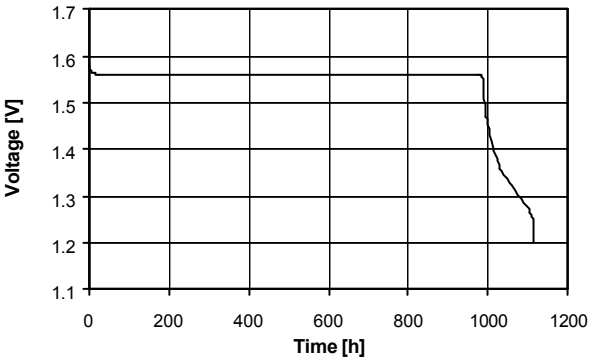
(according IEC 60086-3)

Diameter	11,60 mm (0,457“)
Height	5,40 mm (0,213“)



Discharge Curve

Constant Load	8,25 kΩ
Starting Drain	189,1 µA
Temperature	20°C



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Rev. 357.04 06/05

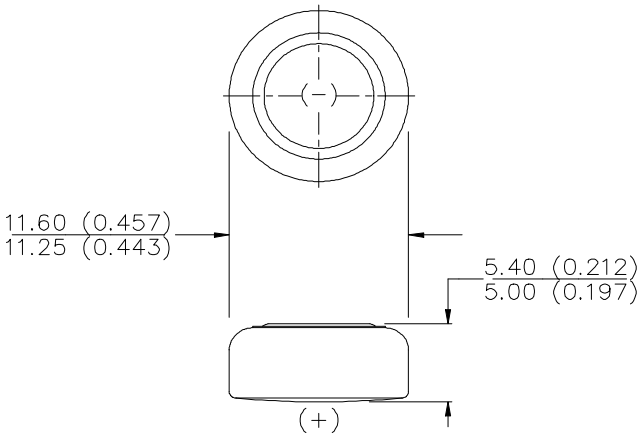
Renata SA
CH-4452 Itingen/Switzerland
Tel. +41 (0)61 975 75 75
Fax. +41 (0)61 975 75 95
sales@renata.com
www.renata.com

Energizer ENGINEERING DATASHEET

EVEREADY BATTERY CO.
Internet: www.energizer.com
1-800-383-7323 / USA
1-800-383-7323 / CANADA
+ 44 (0) 208 920 2306 / EUROPE

ENERGIZER NO. EPX76

Industry Standard Dimensions in mm (inches)

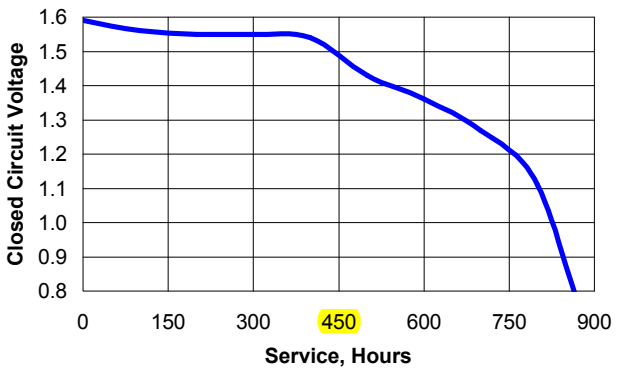


DESIGNED SPECIFICALLY FOR PHOTO USE

Chemical System: Silver Oxide (Zn/Ag_2O)

Designation: ANSI / NEDA-1107SOP, IEC-SR44
Battery Voltage: 1.55 Volts
Average Weight: 2.3 grams (0.08 oz.)
Volume: 0.57 cubic centimeters (0.035 cubic inch)
Average Capacity: 200 mAh to 0.9 volts
(Rated at 6.5k ohms continuous at 21ºC)

TYPICAL DISCHARGE CURVE
Simulated Test @ 21ºC (70ºF)



Simulated Application Test
Estimated Average Service at 21ºC (70ºF)

Schedule:	Typical Drains at 1.55V (milliamperes)	Load (ohms)	Cutoff Voltage 0.9V
24 hours/day	0.238	6,500	840 Hours

INTERNAL RESISTANCE: Closed circuit voltage no less than 1.30 volts on a load of 100 ohms at 21ºC (70ºF) for 0.1 to 2.0 seconds.

= Guaranteed < 19 Ohm

Important Notice

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Contents herein do not constitute a warranty.

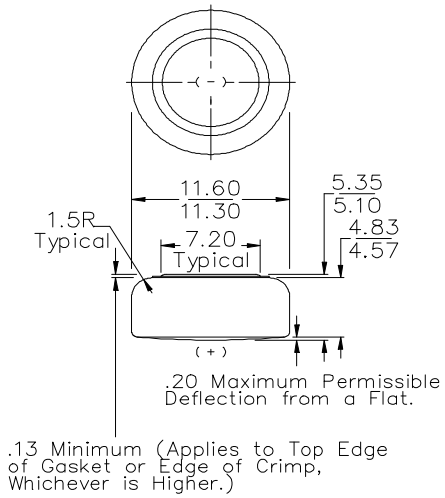
Eveready Battery Company, Inc.

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)

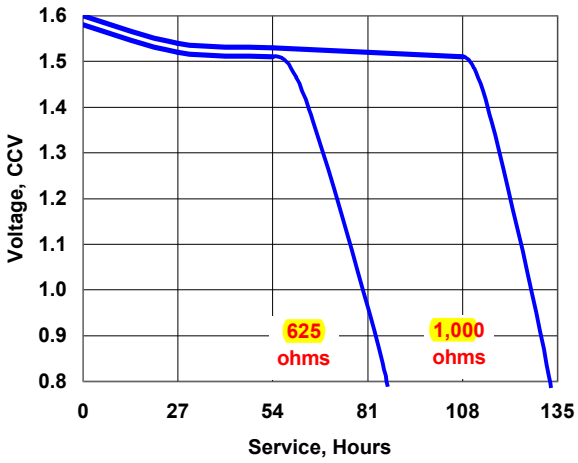
Designation: ANSI / NEDA-1184SO, IEC-SR44
Battery Voltage: 1.55 Volts
Average Weight: 2.27 grams (0.08 oz.)
Volume: 0.57 cubic centimeters (0.035 cubic inch)
Average Service capacity (to 1.3 Volt): 195 mAh
(Rated Capacity at 625 ohms, 16 hrs /day at 21°C)

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

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.

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



Important Notice

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SILVER

PRIMARY
CELLS & BATTERIES

The high volumetric energy density of DURACELL® silver oxide button cells, and their ability to deliver this energy at relatively high current drains, makes them ideal for miniature devices where space is limited. Silver cells also have an extremely stable discharge voltage, good shelf life, and the ability to operate over a wide temperature range.

DURACELL PRODUCT NUMBER	NOMINAL VOLTAGE (V)	RATED CAPACITY[1] (mAh)	RATED VOLTAGE CUTOFF (V)	LOAD (OHMS)	APPROX. DRAIN (mA)	DIMENSIONS MAXIMUM DIAMETER in.	DIMENSIONS MAXIMUM DIAMETER mm	DIMENSIONS MAXIMUM HEIGHT in.	DIMENSIONS MAXIMUM HEIGHT mm	AVERAGE WEIGHT oz.	AVERAGE WEIGHT g	MAXIMUM VOLUME in^3	MAXIMUM VOLUME cm^3	TERMINALS	CROSS REFERENCE NEDA/ANSI	CROSS REFERENCE IEC
SELECTED BUTTON & CYLINDRICAL CELLS																
D301/386	1.55	120	1.2	15,000	0.10	0.455	11.56	0.165	4.19	0.060	1.70	0.026	0.426	FLAT	1133S0	SR43
D303/357	1.55	165	1.2	1,000	1.50	0.455	11.56	0.220	5.58	0.080	2.30	0.033	0.540	FLAT	1131S0	SR44
D309/393	1.55	70	1.2	10,000	0.15	0.310	7.87	0.212	5.38	0.036	1.00	0.015	0.245	FLAT	1137S0	SR48
D361/362	1.55	24	1.2	50,000	0.03	0.308	7.83	0.085	2.15	0.016	0.44	0.006	0.098	FLAT	1158S0	SR720
D364	1.55	18	1.2	50,000	0.03	0.268	6.80	0.085	2.15	0.012	0.35	0.004	0.066	FLAT	1175S0	SR60
D370/371	1.55	33	1.2	30,000	0.05	0.372	9.45	0.085	2.15	0.023	0.64	0.009	0.147	FLAT	1171S0	SR920
D377	1.55	25	1.2	50,000	0.03	0.267	6.78	0.104	2.64	0.014	0.40	0.005	0.082	FLAT	1176S0	SR66
D379	1.55	14	1.2	68,000	0.02	0.228	5.79	0.085	2.15	0.008	0.23	0.003	0.049	FLAT	1191S0	—
D381/391	1.55	40	1.2	15,000	0.10	0.455	11.56	0.087	2.21	0.030	0.85	0.013	0.213	FLAT	1160S0	SR55
D384/392	1.55	42	1.2	15,000	0.10	0.310	7.87	0.142	3.60	0.025	0.72	0.010	0.164	FLAT	1135S0	SR41
D389/390	1.55	70	1.2	13,000	0.11	0.455	11.56	0.120	3.05	0.042	1.20	0.021	0.327	FLAT	1138S0	SR54
D395/399	1.55	55	1.2	30,000	0.05	0.374	9.50	0.106	2.69	0.029	0.81	0.011	0.180	FLAT	1165S0	SR57
D396/397	1.55	30	1.2	30,000	0.05	0.311	7.90	0.104	2.64	0.019	0.54	0.007	0.114	FLAT	1163S0	SR59
MS76	1.55	180	1.2	1,500	1.00	0.455	11.56	0.210	5.33	0.081	2.30	0.033	0.540	FLAT	1184S0	SR44

(1) Rated at 70°F (21°C). Typical capacities can be higher or lower based on user's particular application.

DURACELL®

"EVEREADY" NO EPX76 CELL

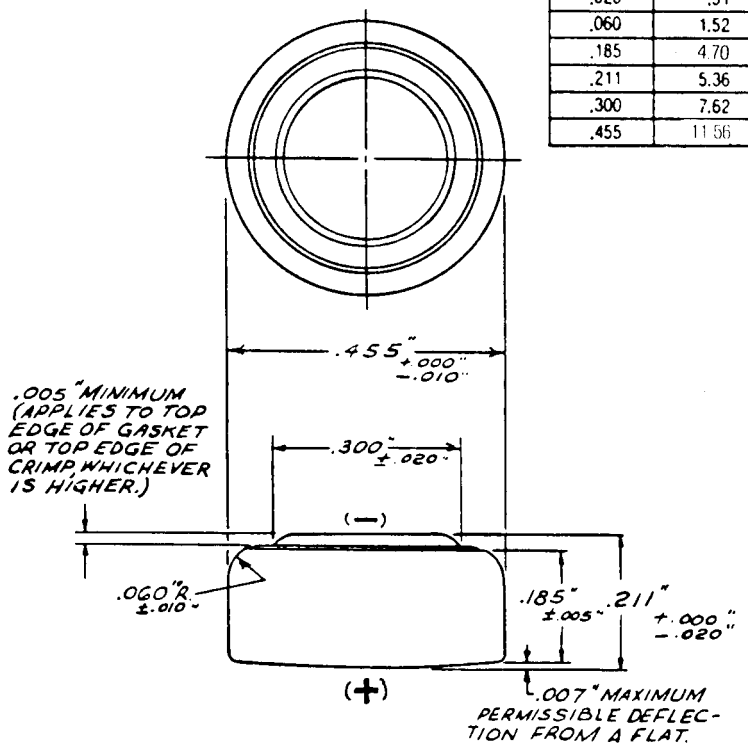
From Original EverReady DataBook

Type: Silver Oxide

Designations: ANSI-S15, IEC-SR44

DESIGNED SPECIFICALLY FOR PHOTO USE

Inches	Millimeters
.005	.13
.007	.18
.010	.25
.020	.51
.060	1.52
.185	4.70
.211	5.36
.300	7.62
.455	11.56



SPECIFICATIONS

Voltage Taps ..... −, + 1.5
Average Service Capacity (to 1.3 volts) ..... 190 milliampere-hours
(Rated capacity at 6,500 ohm load at 35°C)
Terminals ..... Flat Contacts
Average Weight ..... 0.080 oz. (2.27 grams)
Volume ..... 0.029 cubic inch (0.48 cubic centimeter)
Cell ..... One No. 6-45209

For service information see reverse side of this sheet

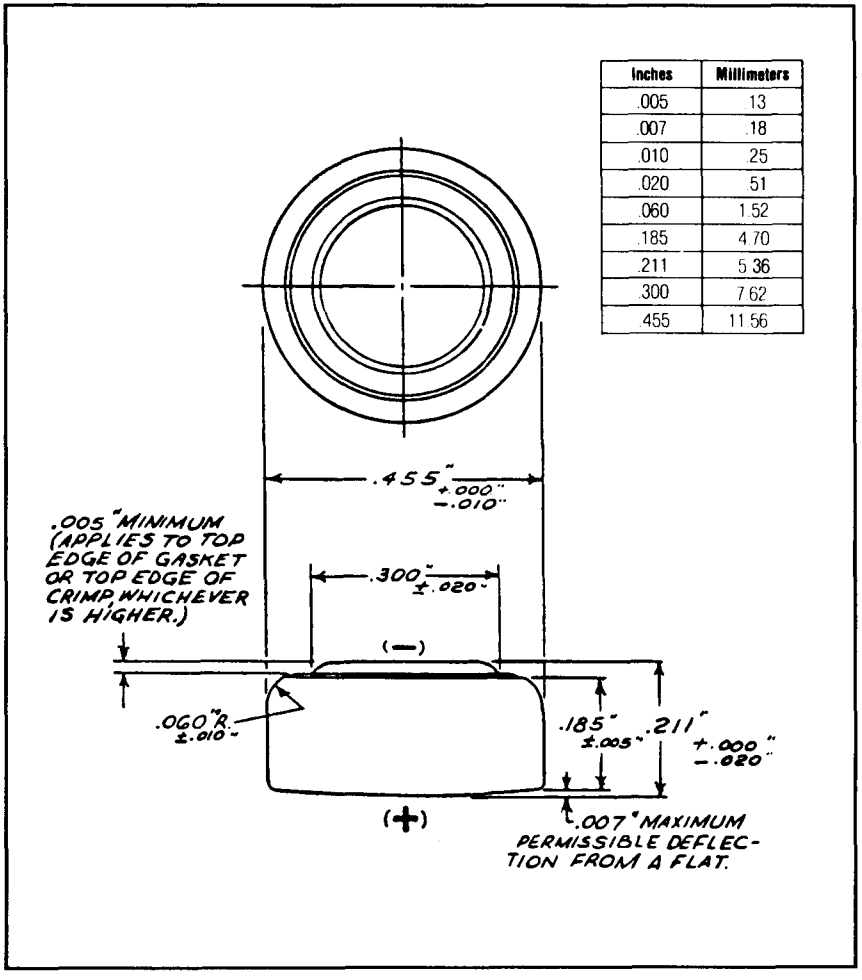
"EVEREADY" NO. D76 CELL

From Original EverReady Databook

Type: Silver Oxide

Designations: ANSI-S15, IEC-SR44

THIS BATTERY IS DESIGNED FOR GENERAL ELECTRONIC APPLICATIONS WHICH MAY REQUIRE HIGH RATE PULSES.



SPECIFICATIONS

Voltage Taps	−, + 1.5
Average Service Capacity (to 0.9 volt) (Rated capacity at 15,000 ohm load at 35 °C)	190 milliampere-hours
Terminals	Flat Contacts
Average Weight	0.080 oz. (2.27 grams)
Volume	0.029 cubic inch (0.48 cubic centimeter)
Cell	One No.6-452011

For service information see reverse side of this sheet

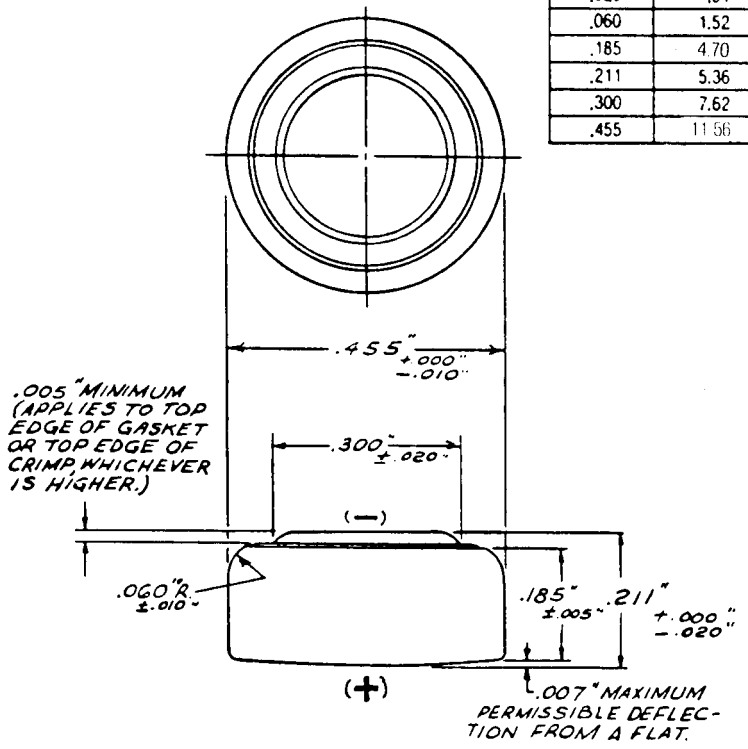
"EVEREADY" NO EPX76 CELL

Type: Silver Oxide

Designations: ANSI-S15, IEC-SR44

DESIGNED SPECIFICALLY FOR PHOTO USE

Inches	Millimeters
.005	.13
.007	.18
.010	.25
.020	.51
.060	1.52
.185	4.70
.211	5.36
.300	7.62
.455	11.56



SPECIFICATIONS

Voltage Taps	−, + 1.5
Average Service Capacity (to 1.3 volts) (Rated capacity at 6,500 ohm load at 35°C)	190 milliampere-hours
Terminals	Flat Contacts
Average Weight	0.080 oz. (2.27 grams)
Volume	0.029 cubic inch (0.48 cubic centimeter)
Cell	One No. 6-45209

For service information see reverse side of this sheet

303

SR1154SW (SR44)
Watch Battery
Swiss Made

Technical Data Sheet

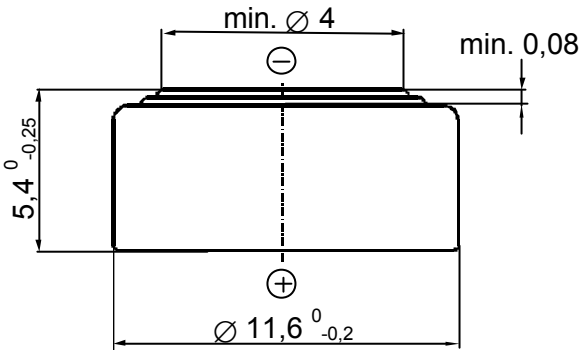
Specifications

Chemical system	Zinc / Monovalent Silver Oxide, low drain
Nominal Voltage	1,55 V
Capacity	175 mAh, Discharge over 8,25 kΩ at 20°C to 1,2 V
Operating Temperature	0°C – 50°C
Self Discharge	Less than 5% per year at 20°C
Weight	~2,27 g

Compared with claimed typ -2% pa for EverReady TH

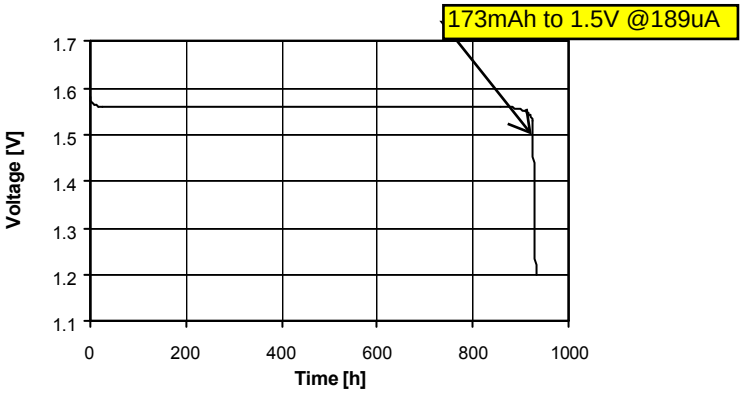
Dimensions

Diameter	11,60 mm (0,457“)
Height	5,40 mm (0,213“)



Discharge Curve

Constant Load	8,25 kΩ
Starting Drain	189,1 µA
Temperature	20°C



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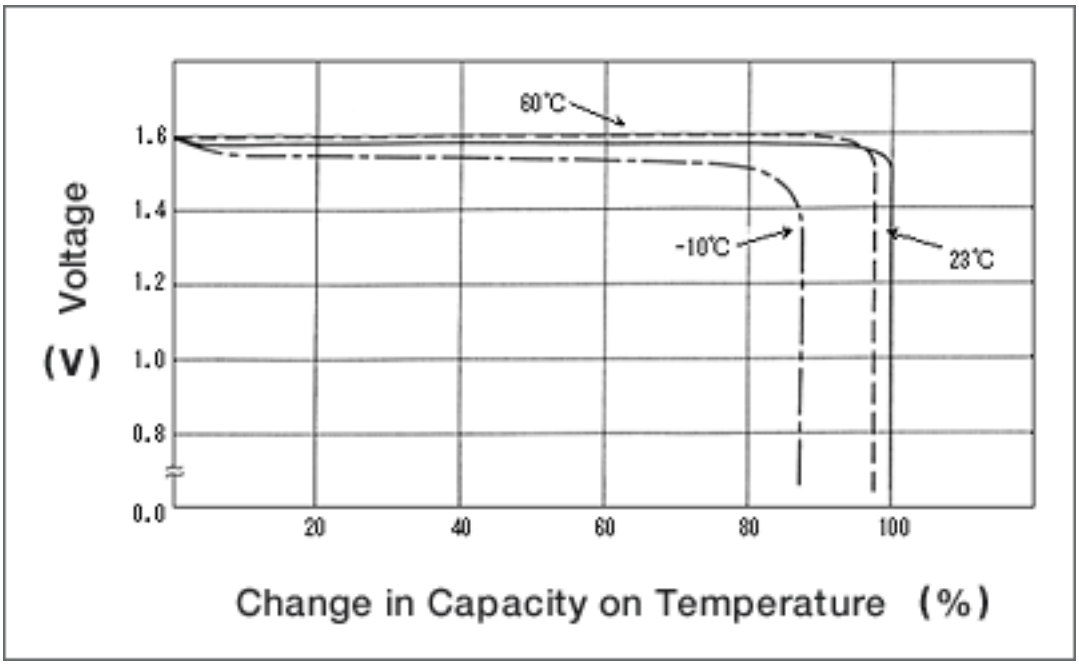
Rev. 303.04 06/05

Renata SA
CH-4452 Itingen/Switzerland
Tel. +41 (0)61 975 75 75
Fax. +41 (0)61 975 75 95
sales@renata.com
www.renata.com

Discharge Characteristics vs. Temperature/Capacity KOH Electrolyte

Discharge Characteristics vs. Temperature/Capacity



Specifications

KOH cells (higher current)

Model	Nominal Voltage (V)	Nominal Capacity (mAh)	Electrical Characteristics				Dimensions		Mass (g)
			Discharge time(h) 1.2V				Diameter (mm)	Height (mm)	
			load (kΩ)	60°	23°	-10°			
SR44W	1.55	180.0	4.7	525	540	470	11.6	5.40	2.40
SR43W	1.55	120.0	6.8	500	520	450			
SR1130W	1.55	85.0	10	520	540	470	11.6	3.05	1.35
SR1120W	1.55	60.0	15	555	575	500	11.6	2.05	0.92
SR1116W	1.55	30.0	30	555	575	500	11.6	1.65	0.73
SR936W	1.55	75.0	10	460	475	410	9.5	3.60	1.02
SR927W	1.55	60.0	15	555	575	500	9.5	2.70	0.78

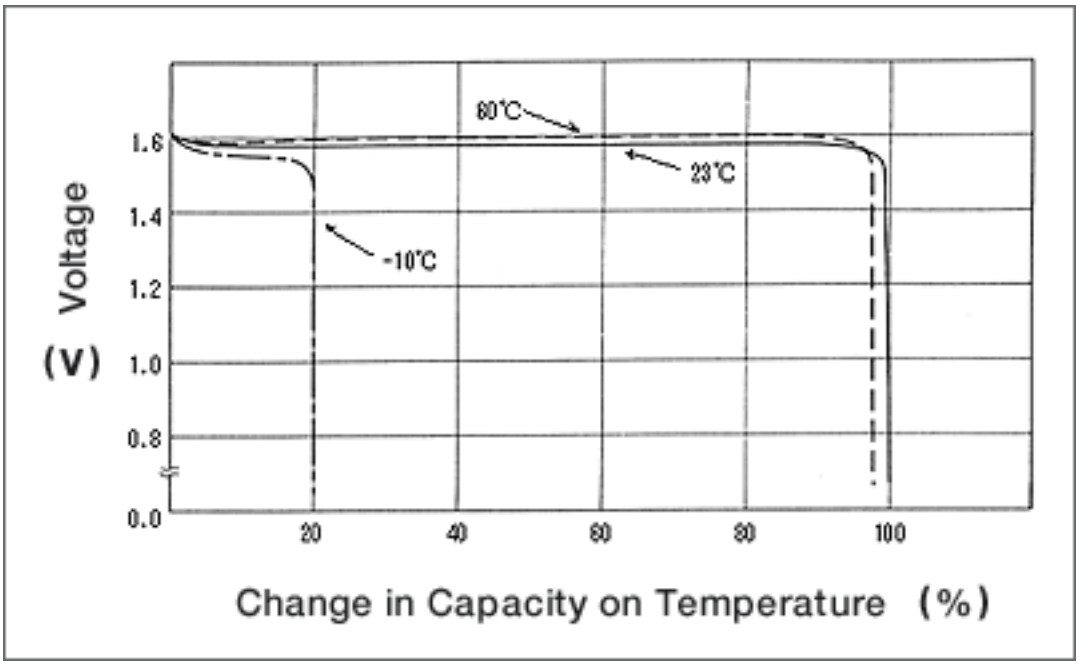
176mAh @329uA @23C TH

SR920W	1.55	40.0	22	540	560	485	9.5	2.05	0.67
SR916W	1.55	26.0	30	480	495	430	9.5	1.65	0.55
SR48W	1.55	75.0	10	460	475	410	7.9	5.40	1.12
SR41W	1.55	45.0	22	610	630	545	7.9	3.60	0.73
SR726W	1.55	35.0	22	475	490	425	7.9	2.60	0.50
SR721W	1.55	29.0	30	535	555	480	7.9	2.10	0.41
SR716W	1.55	16.0	47	465	480	415	7.9	1.65	0.35
SR626W	1.55	28.0	30	515	535	465	6.8	2.60	0.40
SR621W	1.55	20.0	47	580	600	520	6.8	2.15	0.31

*Typical data.

Discharge Characteristics vs. Temperature/Capacity NaOH Electrolyte

Discharge Characteristics vs. Temperature/Capacity



Specifications

These are NaOH cells (low current)
Note cells with suffix SW are low current e.g. SR44SW.
Cells with S suffix are high current e.g. SR44S

Model	Nominal Voltage (V)	Nominal Capacity (mAh)	Electrical Characteristics				Dimensions		Mass (g)
			Discharge time(h) 1.2V				Diameter (mm)	Height (mm)	
			load (kΩ)	60°	23°	-10°			
SR44SW	1.55	165.0	4.7	480	495	100	11.6	5.40	2.25
SR43SW	1.55	110.0	6.8	460	475	95			
SR1130SW	1.55	82.0	10	505	520	105	11.6	3.05	1.35
SR1120SW	1.55	60.0	15	510	525	105	11.6	2.05	0.89
SR1116SW	1.55	33.0	30	610	630	125	11.6	1.65	0.62
SR936SW	1.55	70.0	10	430	445	90	9.5	3.60	1.07
SR927SW	1.55	55.0	15	510	525	105	9.5	2.70	0.80

163mAh @ 330uA 23C

SR920SW	1.55	45.0	22	475	490	100	9.5	2.05	0.53
SR916SW	1.55	30.0	30	555	575	115	9.5	1.65	0.50
SR910SW	1.55	11.5	68	480	495	100	9.5	1.05	0.32
SR41SW	1.55	45.0	15	415	430	85	7.9	3.60	0.71
SR731SW	1.55	39.0	22	525	545	110	7.9	3.10	0.58
SR726SW	1.55	33.0	30	610	630	125	7.9	2.60	0.54
SR721SW	1.55	25.0	30	460	475	95	7.9	2.10	0.41
SR716SW	1.55	23.0	47	670	690	135	7.9	1.65	0.33
SR714SW	1.55	13.0	68	545	565	110	7.9	1.45	0.29
SR712SW	1.55	9.5	100	585	605	120	7.9	1.25	0.24
SR626SW	1.55	28.0	30	520	535	105	6.8	2.60	0.39
SR621SW	1.55	23.0	30	425	440	85	6.8	2.15	0.31
SR616SW	1.55	16.0	47	465	480	95	6.8	1.65	0.25
SR614SW	1.55	13.0	68	545	565	110	6.8	1.45	0.22
SR610SW	1.55	5.3	150	490	505	100	6.8	1.05	0.17
SR527SW	1.55	22.5	47	655	675	135	5.8	2.70	0.29
SR521SW	1.55	16.0	47	495	510	100	5.8	2.15	0.23
SR516SW	1.55	12.5	68	525	540	105	5.8	1.65	0.18
SR512SW	1.55	6.0	150	555	575	115	5.8	1.25	0.13
SR421SW	1.55	12.5	68	525	540	105	4.8	2.15	0.17
SR416SW	1.55	8.3	100	515	530	105	4.8	1.65	0.13
SR410SW	1.55	4.0	150	370	380	75	4.8	1.05	0.08

*Typical data.