ERICAN NATIONAL STANDARD

American National Standard

ANSI C18.1M, Part 1-1999

American National Standard

For Portable Primary Cells and Batteries With Aqueous Electrolyte— General and Specifications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
1300 NORTH 17TH STREET, SUITE 1847, ROSSLYN, VA 22209
(703) 841-3200 FAX: (703) 841-3300

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M-1999, Part 1
Revision of
ANSI C18.1M-1994

American National Standard

For Portable Primary Cells and Batteries With Aqueous Electrolyte— General and Specifications

Secretariat:

National Electrical Manufacturers Association

Approved January 20, 1999

American National Standards Institute, Inc.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

American National Standard

Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

Caution Notice: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, 11 West 42nd Street, New York, NY, 10036, phone 212-642-4900.

Published by

National Electrical Manufacturers Association
1300 N. 17th Street, Rosslyn, VA 22209

© Copyright 1999 by National Electrical Manufacturers Association
All rights including translation into other languages, reserved under the Universal Copyright Convention, the Berne Convention for the Protection of Literary and Artistic Works, and the International and Pan American Copyright Conventions.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Printed in the United States of America

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Contents

Page

Foreword v

1 General 1

1.1 Scope and purpose 1

1.2 Normative references 1

1.3 Definitions 2

1.4 Requirements 3

1.4.1 Designations, chemical systems, and voltages 3

1.4.2 Battery dimensions 4

1.4.3 Terminals 7

1.4.4 General design considerations 8

1.4.5 Test conditions 8

1.4.6 Test requirements 9

1.4.7 Procedures to check conformance to a specified minimum average duration 10

1.4.8 Marking 10

2 Specifications 11

2.1 Specification sheet reference 11

2.2 Battery specification sheets 13

Table

1 Chemical systems and voltages 4

Previous page is blank

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Figures

1 Small cell or battery gauge (inner dimensions) 3

2A Round battery (protruding negative) 6

2B Round battery (recessed negative) 6

3 Button battery 7

Annexes

A Methods of determining load and test conditions 49

B Guidance for packaging, handling, storage, and transportation 51

C Reliability guidelines 53

D Bibliography 55

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

Foreword (This Foreword is not part of American National Standard C18.1M-1999, Part 1.)

This edition of an American National Standard for Portable Primary Cells and Batteries with Aqueous Electrolyte is based in part on the previous American National Standard for Dry Cells and Batteries--Specifications, ANSI C18.1M-1994, and recognizes the work of the International Electrotechnical Commission (refer to IEC Publication 60086-1 and 60086-2) in establishing world-wide standard requirements for portable primary batteries. This edition includes four chemistries:

Carbon zinc (LeClanche and zinc chloride types)
Alkaline manganese dioxide
Silver oxide
Zinc air

In April 1996, the then ANSI Accredited Standards Committee C18 on Specifications for Dry Cells and Batteries established a new general format for the publication of its standards, dividing this standard into two parts. Part 1 of this American National Standard for Portable Primary Cells and Batteries with Aqueous Electrolyte contains two basic sections. The first section has general requirements and information, such as the scope, applicable definitions, general descriptions of battery dimensions, terminal requirements, marking requirements, general design conditions, test conditions, etc. Section 2 of Part 1 is comprised of specification sheets for various types of cells and batteries. **Part 2 of the standard, a separate document, contains safety requirements.**

Suggestions for the improvement of this standard are welcome. They should be sent to the National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209, Attention: Secretary, ANSI ASC C18.

This standard was processed and approved for submittal to ANSI by the American National Standards Committee C18 on Portable Cells and Batteries. Committee approval of this standard does not necessarily imply that all committee members voted for its approval. At the time Committee C18 approved this standard, it had the following members:

Terrence N. Telzrow, Chairperson
Michael H. Babiak, Vice-chairperson
Ronald R. Runkles, Secretary

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Organization Represented:	*Name of Representative:*
Consultant	David Linden
Consultant, U.S. Navy	Albert Himy
Duracell	S. Keel Kelly Steven Wicelinski (Alt.)
Eastman Kodak Company	James C. DeJager Henry J. Heirigs (Alt.)
Energizer	Terrence N. Telzrow Michael H. Babiak (Alt.) Nate M. Banes (Alt.) Ramesh V. Shah (Alt.)
Koehler-Bright Star, Inc.	Harley B. Kaplan Paul Kish (Alt.)
Photographic & Imaging Association	John Gignac
Rayovac Corp.	David L. Wilberg Mel Hammer (Alt.)
U.S. Navy, Crane Division, Naval Surface Warfare Center	James A. Gucinski John Inman
Wilson Greatbatch Limited	William D. Clark Paul W. Krehl (Alt.)

The members of Subcommittee C18-1 for Portable Non-Lithium Primary Cells and Batteries who contributed to the development of this standard are:

David L. Wilberg, Chairperson
Michael H. Babiak, Vice-chairperson
Ronald R. Runkles, Secretary

James Barnes
William Clark
James DeJager
Michael Firshein
James Gucinski
Mel Hammer
Henry Heirigs
Albert Himy
John Inman
Thomas Jones
Keel Kelly
Paul Krehl
David Linden
Terrence Telzrow
Steven Wicelinski

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

AMERICAN NATIONAL STANDARD **ANSI C18.1M-1999, PART 1**

For Portable Primary Cells and Batteries with Aqueous Electrolyte—General and Specifications

1 General

NOTE—Part 1 does not include safety requirements, which can be found in Part 2.

1.1 Scope and purpose

1.1.1 Scope

This standard applies to portable primary cells and batteries with aqueous electrolyte and a zinc anode (non-lithium). This edition includes the following electrochemical systems:

a) Carbon zinc (LeClanche and zinc chloride types);
b) Alkaline manganese dioxide;
c) Silver oxide;
d) Zinc air.

1.1.2 Purpose

The purpose of this publication is:

a) To ensure the electrical and physical interchangeability of products from different manufacturers;
b) To minimize proliferation of cell and battery types;
c) To define a standard of performance and provide guidance for its assessment;
d) To provide guidance to consumers, manufacturers, and designers.

This is achieved by specifying nomenclature, dimensions, polarity, terminals, marking, test conditions, and procedures.

1.2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ANSI/ASME Y14.5-1994, *Dimensioning and tolerancing*

ANSI C18.1M-1999, Part 2, *Portable primary cells and batteries with aqueous electrolyte—safety standard*

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS Not for Resale

1.3 Definitions

1.3.1 anode: Electrode at which an electrochemical oxidation reaction occurs.

1.3.2 application test: A test which simulates the actual use of a battery in a specific application.

1.3.3 battery: One or more cells, including case, terminals, and markings.

1.3.4 battery, button: Small round battery, in which the overall height is less than the diameter.

1.3.5 battery, portable: A battery that is easily carried.

1.3.6 battery, primary: A battery that is not designed to be recharged.

1.3.7 battery, prismatic: A battery with non-round geometry.

1.3.8 battery, round: Cylindrical battery, the overall height of which is greater than or equal to its diameter.

1.3.9 capacity: Quantity of electricity, usually expressed in Ampere-hours (Ah), which a battery can deliver under specified discharge conditions.

1.3.10 cathode: Electrode at which an electrochemical reduction reaction occurs.

1.3.11 cell: Basic functional unit providing a source of electrical energy by direct conversion of chemical energy. The cell consists of an assembly of electrodes, separators, electrolyte, container, and terminals.

1.3.12 cell, primary: A cell that is not designed to be recharged electrically.

1.3.13 discharge: An operation during which a battery delivers power (current and voltage) by the conversion of chemical energy into electrical energy to an external circuit.

1.3.14 electrode: Conductive part, electrically connected to one terminal of a cell, forming an interface with the electrolyte and on which the electrode reaction occurs.

1.3.15 electrolyte: Medium containing mobile ions which render it ionically conductive.

1.3.16 leakage: The escape of electrolyte from a cell or battery.

1.3.17 minimum average duration: The required average value of service output under specified test conditions.

1.3.18 polarity: The electrical convention used to describe the direction in which current flows on discharge.

1.3.19 rating test: A discharge test used to measure the service output of a battery.

1.3.20 resistance, internal: Apparent opposition to current flow within a battery that manifests itself as a drop in voltage proportional to the discharge current. Its value depends on battery design, state of charge, temperature, and age.

1.3.21 service output: Capacity or energy output of a cell or battery under specified conditions of discharge. It may be expressed as duration, number of pulses, ampere-hours, or in watt-hours.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS Not for Resale

1.3.22 small cell or battery: A cell or battery fitting within the limits of the truncated cylinder as defined in Figure 1.

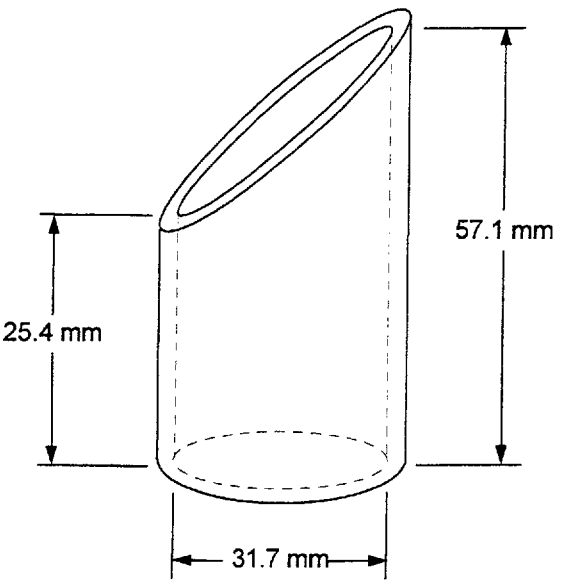


Figure 1 – Small cell or battery gauge (inner dimensions)

1.3.23 terminals: Accessible conductive parts provided for the connection of an external circuit to the positive (+) and negative (-) electrodes of the cell or battery.

1.3.24 voltage, closed circuit (CCV): The voltage of a battery when external current is flowing.

1.3.25 voltage, end point: Specified voltage of a battery, when supplying power, at which the discharge is terminated.

1.3.26 voltage, nominal: Suitable approximate value used to designate or identify the voltage of a cell, battery, or electrochemical system.

1.3.27 voltage, open circuit (OCV): The voltage of a battery when no external current is flowing.

1.4 Requirements

1.4.1 Designations, chemical systems, and voltages

1.4.1.1 Designations

Batteries are listed by their ANSI numbers and letter suffixes. Definitions of the letters are:

A	Alkaline
AC	Alkaline industrial
AP	Alkaline photographic
No suffix	Carbon zinc
C	Carbon zinc industrial
CD	Carbon zinc industrial, heavy duty
D	Carbon zinc heavy duty

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

F	Carbon zinc general purpose
SO	Silver oxide
SOP	Silver oxide photographic
Z	Zinc air
ZD	Zinc air heavy duty

1.4.1.2 Chemical systems and voltages

Table 1 – Chemical systems and voltages

Chemical system	Positive electrode	Electrolyte	Negative electrode	Nominal voltage	Max open circuit voltage
Alkaline manganese	Manganese dioxide	Alkali metal hydroxide	Zinc	1.5	1.65
Carbon zinc	Manganese dioxide	Ammonium chloride and/or Zinc chloride	Zinc	1.5	1.80
Silver oxide	Silver oxide	Alkali metal hydroxide	Zinc	1.5	1.63
Zinc air	Oxygen	Alkali metal hydroxide	Zinc	1.4	1.68

1.4.2 Battery dimensions

In some cases, a battery is adequately defined by two or three linear dimensions. For some batteries, it is necessary to describe the battery in greater detail by specifying additional battery dimensions. Asymmetry of battery shape or terminals enable the compartment to be designed so that batteries can be inserted only with the correct orientation.

1.4.2.1 Dimension symbols

Symbols denoting various dimensions are as follows (note that some of the symbols and terms are defined in 1.4.2.2):

A	maximum overall height of the battery
B	minimum distance between the flats of the positive and negative terminals
C	minimum outer diameter of the flat surface of the negative terminal
E	maximum recess of the flat surface of the negative terminal
F	maximum diameter of the positive terminal within the specified projection height
G	minimum projection height of the flat surface of the positive terminal
K	minimum projection of the flat surface of the negative terminal
L	maximum diameter of the negative terminal within the specified projection height
M	minimum diameter of the flat surface of the negative contact
Ⓜ	maximum material condition
N	minimum diameter of the flat surface of the positive terminal
∅	maximum and minimum diameters of the battery
⊕	true position
P	datum feature
T	positional tolerance of the positive terminal

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

1.4.2.2 Dimension definitions

1.4.2.2.1 Datum

A datum is a theoretically exact point, axis, or plane derived from the true geometric counterpart of a specified datum feature. It is the origin from which the location or geometric characteristics of features of a part are established.

1.4.2.2.2 Datum feature

A datum feature is an actual feature of a part that is used to establish a datum.

1.4.2.2.3 Datum feature symbol

A datum feature symbol is used to identify an actual part feature serving as a datum feature. An example of a datum feature symbol is " P ."

1.4.2.2.4 Maximum material condition

The maximum material condition is the condition in which a feature of size contains the maximum amount of material within the stated limits of size (e.g., minimum hole diameter, maximum shaft diameter).

1.4.2.2.5 Positional tolerance

A positional tolerance defines a zone within which the center, axis, or center plane of a feature of given size is permitted to vary from a true position.

1.4.2.2.6 True position

A true position is the theoretically exact location of a feature established by basic dimensions.

1.4.2.3 Positional tolerancing of the positive terminal

The positive terminal shall be located within the allowed tolerance T with respect to the diameter of the cell. The diameter of the cell is specified to be the datum feature. The tolerance is indicated at the maximum material condition, or when the terminal is actually at its largest diameter. Additional tolerance is obtained by making the positive terminal smaller in diameter, subject to passing the N dimension for positive terminal minimum flatness diameter.

1.4.2.4 Basic shapes of batteries

Basic battery shapes, including dimension symbols, are illustrated in Figures 2 and 3.

1.4.3 Terminals

1.4.3.1 General

Each cell or battery shall be supplied with terminals as specified in the appropriate specification sheet and according to the following general comments.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

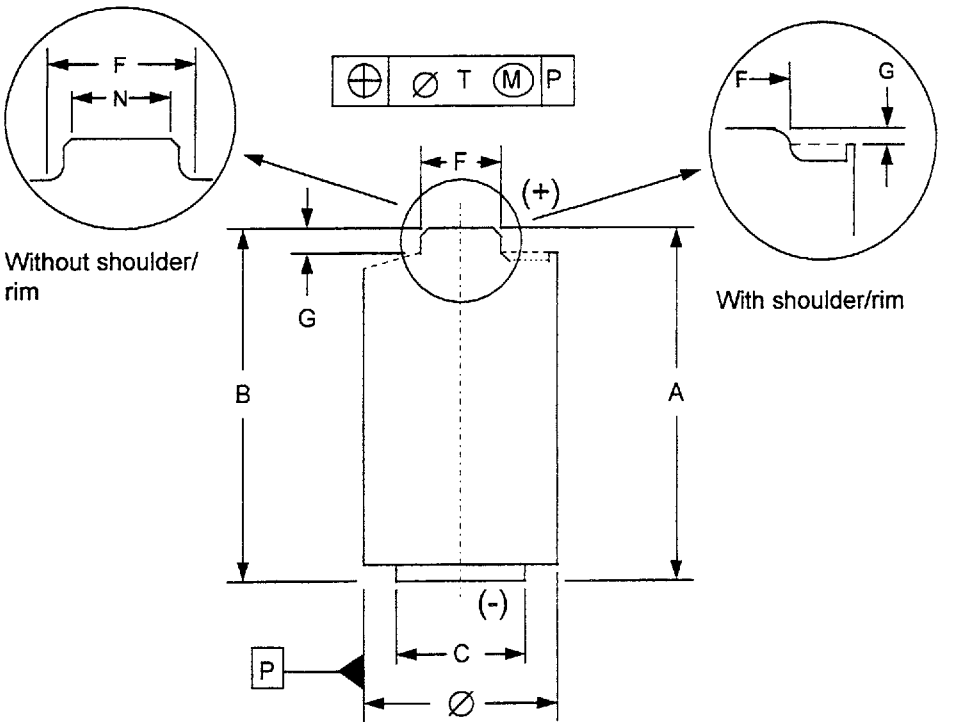


Figure 2A – Round battery (protruding negative)

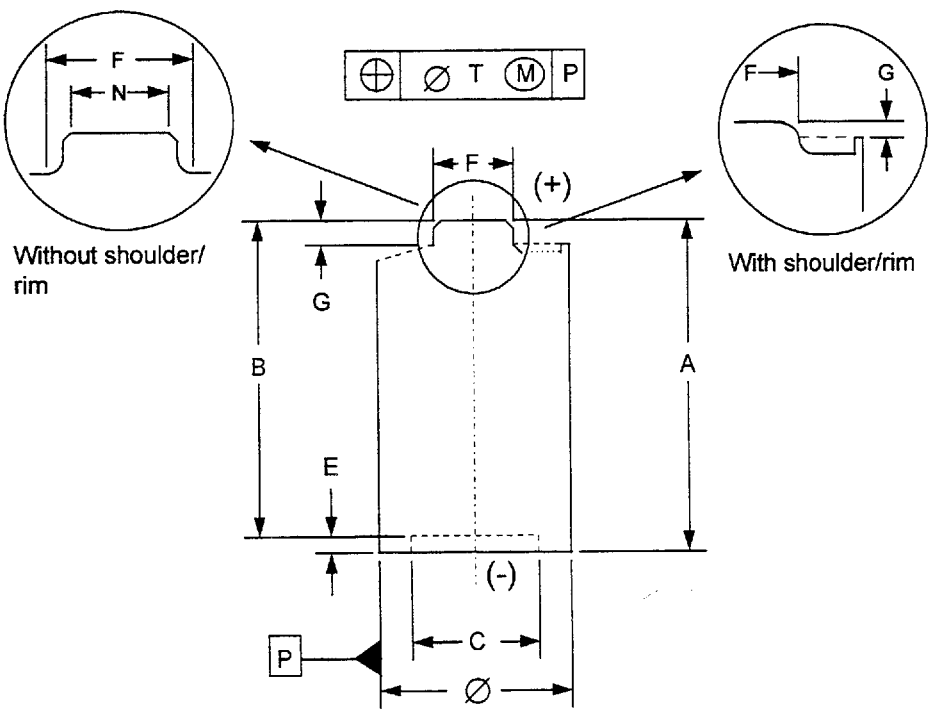


Figure 2B – Round battery (recessed negative)

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

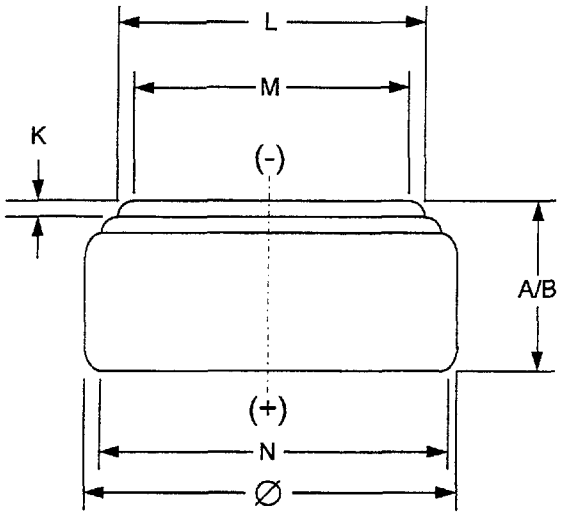


Figure 3 – Button battery

1.4.3.2 Cap and base

This type of terminal is used for batteries that have specified dimensions according to Figure 2 and have the cylindrical side insulated from the terminals. The metal cap on the center electrode and the bottom of the battery serve as the terminals.

1.4.3.2.1 Protruding negative terminal (Figure 2A, solid line)

The bottom construction shall ensure good electrical contact when the battery is placed on a flat metal surface.

1.4.3.2.2 Recessed negative terminal (Figure 2B, dashed line)

The recessed terminal shall be such that when two or more batteries are placed in series, the cap of one battery will not project within the recess in the bottom of the adjacent battery to a degree that will cause the height of the stacked batteries, measured terminal to terminal, to be less than the number of batteries multiplied by their B dimension.

1.4.3.3 Cap and case

This type of terminal is used for batteries that have specified dimensions according to Figure 3. The cylindrical side of the battery forms part of the positive terminal.

1.4.3.4 Snap

This type of terminal consists of a stud for the positive terminal and a socket for the negative terminal. These shall be made from nickel-plated steel or other suitable material. They shall be designed to provide a secure physical and electrical connection, when fitted with similar corresponding parts, for connection to an electrical circuit.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

1.4.3.5 Knurled-nut and screw terminals

These terminals shall be made of brass or other suitable material.

1.4.3.6 Spiral-spring terminals

These terminals shall consist of spirally wound wire in a form suitable to provide a pressure contact. They shall be made of spring brass or other suitable metal.

1.4.3.7 "Plug-in" sockets

This type of terminal shall consist of a suitable assembly of metal contacts, mounted in an insulated housing or holder and adapted to receive corresponding pins of a mating plug to ensure good electrical contact. The metal contacts shall be made of tinned brass or other suitable metal.

1.4.4 General design considerations

1.4.4.1 Dimensional stability

The dimensions of batteries shall remain within specified dimensional tolerances under conditions of storage and discharge, specified herein.

1.4.4.2 Leakage

Batteries shall not leak during discharge when tested under the conditions given in 2.2.

1.4.5 Test conditions

1.4.5.1 Environmental conditions

1.4.5.1.1 Standard temperature

The ambient temperature surrounding the battery shall be 21° ± 2°C. During short periods only, the temperature may deviate from these limits without exceeding 21° ± 5°C.

1.4.5.1.2 Standard relative humidity

The relative humidity shall be between 35% and 65%, unless otherwise specified.

1.4.5.2 Discharge conditions

1.4.5.2.1 Environmental conditions

Unless otherwise specified, discharge tests are to be carried out at standard temperature and standard relative humidity.

All minimum average duration values given in this specification refer to batteries stored and discharged under standard conditions of temperature and relative humidity.

1.4.5.2.2 Storage before discharge

1.4.5.2.2.1 Initial tests

Initial tests intended to show the conditions of fresh batteries shall be started within 30 days after shipment by the manufacturer.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

1.4.5.2.2.2 Twelve-month tests

Twelve-month tests are intended to assess the one year storage performance of batteries. Batteries subjected to this test shall be stored on open circuit at the standard temperature and relative humidity (refer to 1.4.5.1.1 and 1.4.5.1.2) for a period of 12 months. Zinc air cells shall be stored with air access holes sealed until tested. The 12 month storage time shall be measured from the time of shipment by the manufacturer.

1.4.6 Test requirements

1.4.6.1 Resistive load

The value of the resistive load (which includes all parts of the external circuit) shall be accurate to within 0.5%.

The load in ohms shall appear in the individual specification sheets and shall be one of the following, along with their multiples:

1.00	1.10	1.20	1.30	1.50	1.60	1.80	2.00
2.20	2.40	2.70	3.00	3.30	3.60	3.90	4.30
4.70	5.10	5.60	6.20	6.80	7.50	8.20	9.10

The value of any other non-resistive loads shall be specified in the individual specification sheet and shall be accurate to within 1%.

1.4.6.2 Time periods

The closed circuit and open circuit periods shall be as specified in the individual specification sheets.

1.4.6.3 Determination of service output

To determine the service output, batteries shall be discharged on each test as specified in the individual specification sheet until the closed circuit voltage drops for the first time below the specified end point voltage.

When a specification sheet designates more than one service output test, batteries shall meet the requirements of all these tests to be in compliance with this standard.

1.4.6.4 Voltage measurement

The accuracy of voltage measurements shall be within 0.01 V for each 1.5 V. The resistance of the measuring instrument shall be at least ten times the discharge resistance, but with a minimum of 20,000 ohms per volt of scale.

1.4.6.5 Leakage and deformation determination

After the service output has been determined using the criteria on the individual specification sheets, the discharge shall be continued in the same way until the closed circuit voltage drops for the first time below 40% of the nominal voltage of the battery. The requirements of 1.4.4.1 and 1.4.4.2 shall be met, except that an increase in battery height of 0.25 mm over the maximum specified value is allowed for button cells of the A, SO, and Z systems.

1.4.6.6 Methods of determining discharge test conditions

The discharge tests in this standard are divided into two categories:

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

a) Application
b) Rating or capacity

In both categories of tests, loads are specified in accordance with 1.4.6.1.

1.4.6.7 Activation of zinc air batteries

A period of at least ten minutes shall elapse between activation and the commencement of electrical measurement.

1.4.7 Procedures to check conformance to a specified minimum average duration

a) Test nine batteries.
b) Calculate the average without the exclusion of any results.
c) If this average is equal to or greater than the specified value and no more than one battery has a service output of less than 80% of the specified value, the batteries are considered to conform for service output.
d) If this average is less than the specified value and/or more than one battery has a service output of less than 80% of the specified value, repeat the test on another sample of nine batteries and calculate the average as previously described.
e) If the average of this second test is equal to or greater than the specified value and no more than one battery has a service output of less than 80% of the specified value, the batteries are considered to conform for service output.
f) If the average of the second test is less than the specified value and/or more than one battery has a service output of less than 80% of the specified value, the batteries are considered not to conform and no further testing is permitted.

1.4.8 Marking

1.4.8.1 General

At least the following items shall be marked on the battery or package:

a) Battery system—except carbon zinc
b) Designation
c) Polarity of terminal (when applicable)
d) Nominal voltage
e) Year and month or week of manufacture, which may be in code, or the expiration date
f) Name or trade mark of the manufacturer or supplier
g) Warnings or cautionary notes, where applicable
h) Caution for ingestion (small batteries only)

1.4.8.2 Small size batteries

When this subclause is invoked on the individual specifications sheet, items b) and c) shall be marked on the battery. Items a), d), e), f), g), and h) may be given on the immediate packing instead of on the battery.

NOTE—Batteries that are considered "small" are so noted on the individual battery specification sheets in 2.2.

For zinc air batteries, b) and c) may be marked on the sealing tab of the battery or on the battery; d), e), and f) may be given on the immediate packaging, instead of on the battery.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS Not for Resale

2 SPECIFICATIONS

2.1 Specification sheet reference

ANSI Number	IEC Designation	Common Designation	Volts	Chemistry	Page
13A	LR20	D	1.5	Alkaline Manganese	15
13AC	LR20	D	1.5	Alkaline Manganese	15
13C	R20S	D	1.5	Carbon Zinc	15
13CD	R20C	D	1.5	Carbon Zinc	15
13D	R20C	D	1.5	Carbon Zinc	15
13F	R20S	D	1.5	Carbon Zinc	15
14A	LR14	C	1.5	Alkaline Manganese	17
14AC	LR14	C	1.5	Alkaline Manganese	17
14C	R14S	C	1.5	Carbon Zinc	17
14CD	R14C	C	1.5	Carbon Zinc	17
14D	R14C	C	1.5	Carbon Zinc	17
14F	R14S	C	1.5	Carbon Zinc	17
15A	LR6	AA	1.5	Alkaline Manganese	19
15AC	LR6	AA	1.5	Alkaline Manganese	19
15AP	LR6	AA	1.5	Alkaline Manganese	19
15C	R6S	AA	1.5	Carbon Zinc	19
15CD	R6C	AA	1.5	Carbon Zinc	19
15D	R6C	AA	1.5	Carbon Zinc	19
15F	R6S	AA	1.5	Carbon Zinc	19
24A	LR03	AAA	1.5	Alkaline Manganese	21
24AC	LR03	AAA	1.5	Alkaline Manganese	21
24AP	LR03	AAA	1.5	Alkaline Manganese	21
24D	R03	AAA	1.5	Carbon Zinc	21
25A	-	-	1.5	Alkaline Manganese	22
903	-	-	7.50	Carbon Zinc	23
904	-	-	9.00	Carbon Zinc	24
908	4R25X	-	6.00	Carbon Zinc	25
908A	4LR25X	-	6.00	Alkaline Manganese	25
908AC	4LR25X	-	6.00	Alkaline Manganese	25
908C	4R25X	-	6.00	Carbon Zinc	25
908CD	4R25X	-	6.00	Carbon Zinc	25
908D	4R25X	-	6.00	Carbon Zinc	25
910A	LR1	L20	1.5	Alkaline Manganese	26
915	4R25Y	-	6.00	Carbon Zinc	27
915A	4LR25Y	-	6.00	Alkaline Manganese	27
915AC	4LR25Y	-	6.00	Alkaline Manganese	27
915C	4R25Y	-	6.00	Carbon Zinc	27
915D	4R25Y	-	6.00	Carbon Zinc	27
918	4R25-2	-	6.00	Carbon Zinc	28
918A	-	-	6.00	Alkaline Manganese	28
918AC	-	-	6.00	Alkaline Manganese	28
918D	4R25-2	-	6.00	Carbon Zinc	28
926	-	-	12.0	Carbon Zinc	29
926AC	-	-	12.0	Alkaline Manganese	29
1107SOP	SR44	S15	1.5	Silver Oxide	30

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI Number	IEC Designation	Common Designation	Volts	Chemistry	Page
1131SO	SR44	-	1.5	Silver Oxide	30
1132SO	SR43	-	1.5	Silver Oxide	31
1133SO	SR43	-	1.5	Silver Oxide	31
1134SO	SR41	-	1.5	Silver Oxide	32
1135SO	SR41	-	1.5	Silver Oxide	32
1136SO	SR48	-	1.5	Silver Oxide	33
1137SO	SR48	-	1.5	Silver Oxide	33
1138SO	SR54	-	1.5	Silver Oxide	34
1139SO	SR42	-	1.5	Silver Oxide	35
1158SO	SR58	-	1.5	Silver Oxide	36
1160SO	SR55	-	1.5	Silver Oxide	37
1162SO	SR57	-	1.5	Silver Oxide	38
1163SO	SR59	-	1.5	Silver Oxide	39
1164SO	SR59	-	1.5	Silver Oxide	39
1165SO	SR57	-	1.5	Silver Oxide	38
1166A	LR44	-	1.5	Alkaline Manganese	30
1170SO	SR55	-	1.5	Silver Oxide	37
1175SO	SR60	-	1.5	Silver Oxide	40
1177SO	-	-	1.5	Silver Oxide	41
1179SO	SR41	-	1.5	Silver Oxide	32
1181SO	SR48	-	1.5	Silver Oxide	33
1184SO	SR44	-	1.5	Silver Oxide	30
1191SO	-	-	1.5	Silver Oxide	42
1406SOP	4SR44	-	1.5	Silver Oxide	43
1412AP	4LR61	-	6.00	Alkaline Manganese	44
1414A	4LR44	-	6.00	Alkaline Manganese	43
1604	6F22	-	9.00	Carbon Zinc	45
1604A	6LR61	-	9.00	Alkaline Manganese	45
1604AC	6LR61	-	9.00	Alkaline Manganese	45
1604C	6F22	-	9.00	Carbon Zinc	45
1604CD	6F22	-	9.00	Carbon Zinc	45
1604D	6F22	-	9.00	Carbon Zinc	45
7000ZD	PR48	-	1.40	Zinc Air	33
7002ZD	PR41	-	1.40	Zinc Air	32
7003ZD	PR44	-	1.40	Zinc Air	30
7004Z	-	-	8.40	Zinc Air	45
7005ZD	PR70	-	1.40	Zinc Air	46
7007Z	-	-	1.40	Zinc Air	47
7012Z	-	-	1.40	Zinc Air	42

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

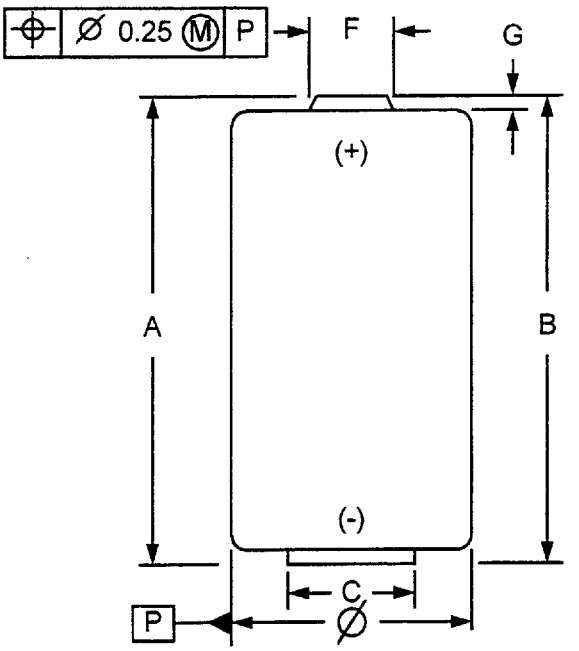
2.2 Battery specification sheets

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

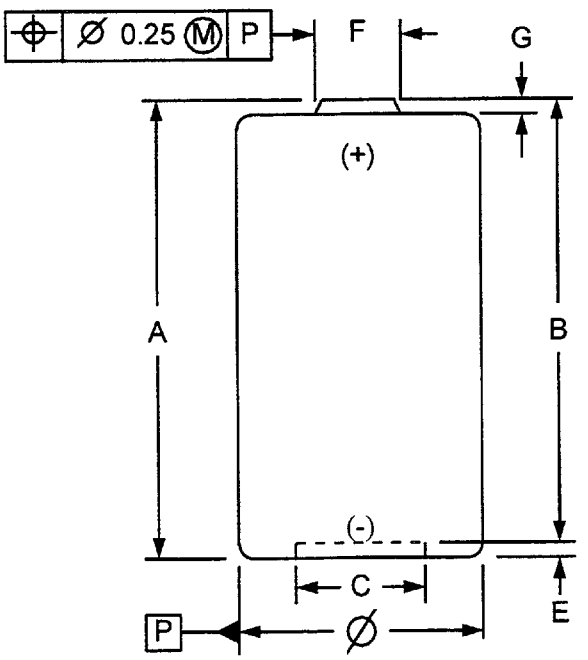
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	13

Protruding Negative Terminal



Recessed Negative Terminal



Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	13

Dimensions	Millimeters	Inches
A (Max)	61.5	2.421
B (Min)	59.5	2.343
C (Min)	18.0	0.709
E (Max)	1.0	0.039
F (Max)	9.5	0.374
G (Min)	1.5	0.059
∅ (Max)	34.2	1.346
∅ (Min)	32.3	1.272

NOTE—Terminals: Cap and base

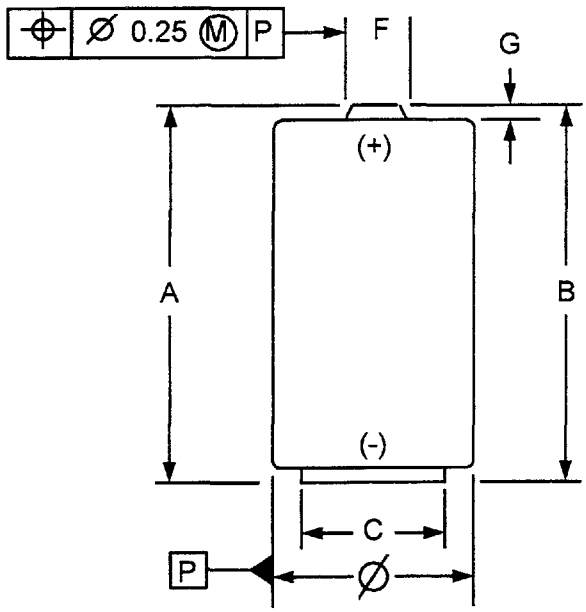
Designation	ANSI	13A 13AC	13CD 13D	13C 13F
	IEC	LR20	R20C R20P	R20S
Electrochemical system		Alkaline manganese dioxide	Carbon zinc	Carbon zinc
Nominal voltage		1.5	1.5	1.5
Maximum off-load voltage		1.65	1.80	1.80
Performance after 12 months		90%	80%	80%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration		
Portable Lighting	1.5	4 min/ 15 min 8 hr/d	0.9	540 min	150 min	45 min
Portable Lighting	2.2	4 min/hr 8 hr/d	0.9	950 min	320 min	130 min
Toys	2.2	1 hr	0.8	17.5 hr	5.5 hr	2 hr
Tape Recorder	3.9	1 hr	0.9	26 hr	10 hr	4.5 hr
Transistor Radio	10	4 hr	0.9	90 hr	33 hr	18 hr

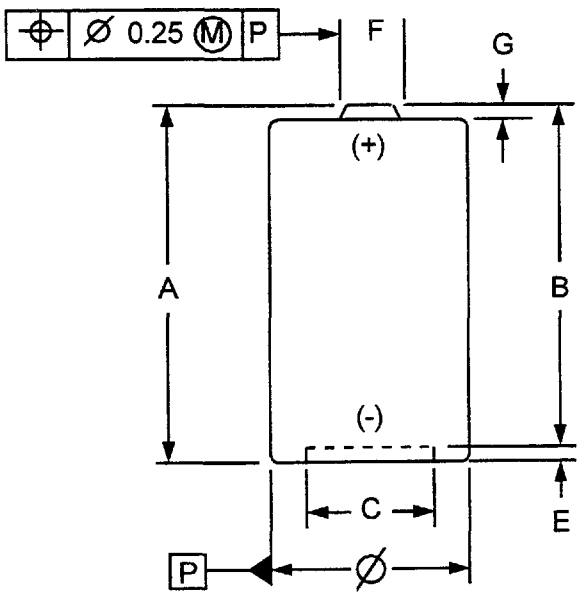
Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	14

Protruding Negative Terminal



Recessed Negative Terminal



Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	14

Dimensions	Millimeters	Inches
A (Max)	50.0	1.969
B (Min)	48.5	1.909
C (Min)	13.0	0.512
E (Max)	0.9	0.035
F (Max)	7.5	0.295
G (Min)	1.5	0.059
∅ (Max)	26.2	1.031
∅ (Min)	24.9	0.980

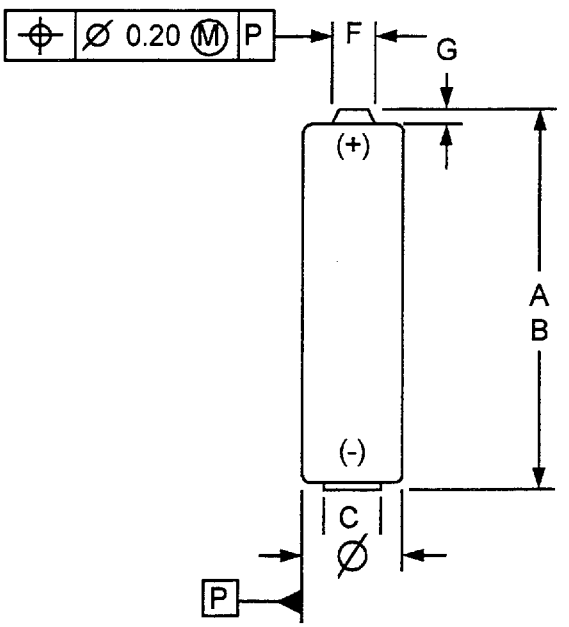
NOTE—Terminal: Cap and base

Designation	ANSI	14A 14AC	14CD 14D	14C 14F
	IEC	LR14	R14C R14P	R14S
Electrochemical system		Alkaline manganese dioxide	Carbon zinc	Carbon zinc
Nominal voltage		1.5	1.5	1.5
Maximum off-load voltage		1.65	1.80	1.80
Performance after 12 months		90%	80%	80%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration		
Portable Lighting	3.9	4 min/hr 8 hr/d	0.9	830 min	350 min	140 min
Toys	3.9	1 hr	0.8	14.5 hr	5.5 hr	2 hr
Tape Recorder	6.8	1 hr	0.9	24 hr	10 hr	4 hr
Transistor Radio	20	4 hr	0.9	85 hr	30 hr	16 hr

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	15



Dimensions	Millimeters	Inches
A (Max)	50.5	1.988
B (Min)	49.2	1.937
C (Min)	7.0	0.276
F (Max)	5.5	0.217
G (Min)	1.0	0.039
Ø (Max)	14.5	0.571
Ø (Min)	13.5	0.531

Notes
1. Terminals: Cap and base
2. B (Min): 49.5 mm [1.949 in] is under consideration.
3. G (Min): 1.2 mm [0.047 in] is under consideration.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

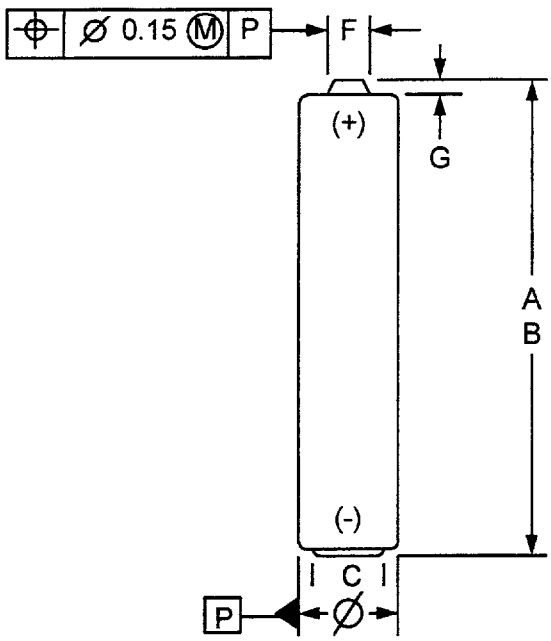
ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	15

Designation	ANSI	15A 15AC 15AP	15CD 15D	15C 15F
	IEC	LR6	R6C R6P	R6S
Electrochemical system		Alkaline manganese dioxide	Carbon zinc	Carbon zinc
Nominal voltage		1.5	1.5	1.5
Maximum off-load voltage		1.65	1.80	1.80
Performance after 12 months		90%	80%	80%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration		
Pulse test (photo)	1.8	15 sec/min	0.9	450 pulses	100 pulses	25 pulses
Motor & toys	3.9	1 hr	0.8	5 hr	1.2 hr	0.5 hr
Personal tape recorder & cassette player	10	1 hr	0.9	13.5 hr	4.7 hr	2.5 hr
Transistor Radio	43	4 hr	0.9	60 hr	27 hr	19 hr

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	24



Dimensions	Millimeters	Inches
A (Max)	44.5	1.752
B (Min)	43.3	1.705
C (Min)	4.3	0.169
F (Max)	3.8	0.150
G (Min)	0.8	0.031
Ø (Max)	10.5	0.413
Ø (Min)	9.5	0.374

NOTES	Small Battery
1. Terminals: Cap and base 2. B (Min) of 43.5 mm [1.713 in] is under consideration. 3. G (Min) of 1.0 mm [0.039 in] is under consideration.	

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

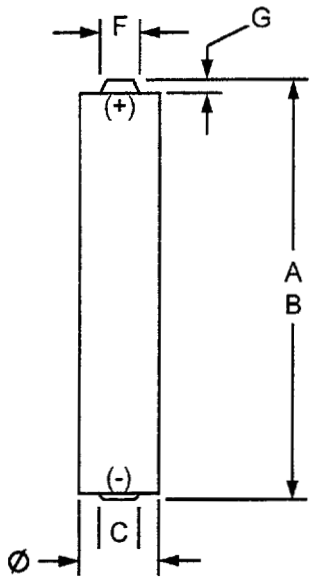
ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	24

Designation	ANSI	24A 24AC 24AP	24D
	IEC	LR03	R03
Electrochemical system		Alkaline manganese dioxide	Carbon zinc
Nominal voltage		1.5	1.5
Maximum off-load voltage		1.65	1.80
Performance after 12 months		90%	80%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration	
Pulse test (photo)	3.6	15 sec/min 24 hr/d	0.9	450 pulses	150 pulses
Portable lighting	5.1	4 min/hr 8 hr/d	0.9	130 min	48 min
Personal tape & cassette player	10	1 hr	0.9	5.5 hr	1.5 hr
Transistor radio	75	4 hr	0.9	48 hr	24 hr

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	25



Dimensions	Millimeters	Inches
A (Max)	42.5	1.673
B (Min)	41.5	1.634
C (Min)	4.3	0.169
F (Max)	3.8	0.150
G (Min)	0.7	0.028
Ø (Max)	8.3	0.327
Ø (Min)	7.7	0.303

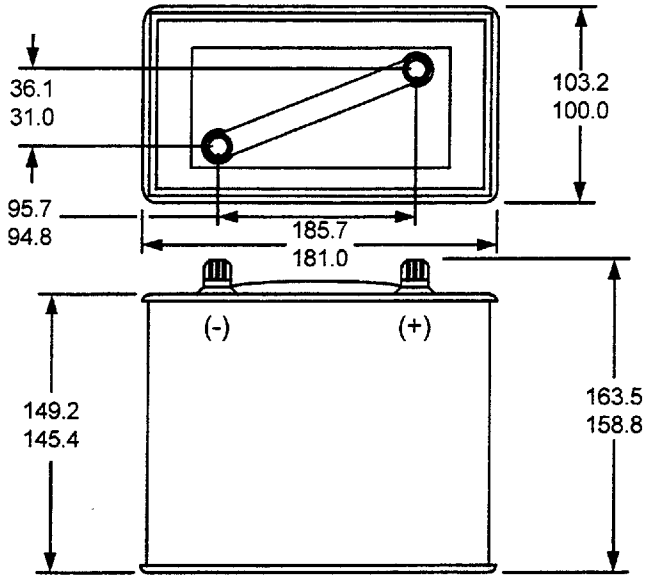
NOTE—Terminals: Cap and base	Small battery

Designation	ANSI	25A
	IEC	---
Electrochemical system		Alkaline manganese dioxide
Nominal voltage		1.5
Maximum off-load voltage		1.65
Performance after 12 months		90%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration
Flashlight	5.1	5 min	0.9	78 min
Rating	75	1 hr	0.9	27 hr

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	903



Millimeters	Inches	Millimeters	Inches	Millimeters	Inches
31.0	1.220	100.0	3.937	158.8	6.252
36.1	1.421	103.2	4.063	163.5	6.437
94.8	3.732	145.4	5.724	181.0	7.126
95.7	3.768	149.2	5.874	185.7	7.311

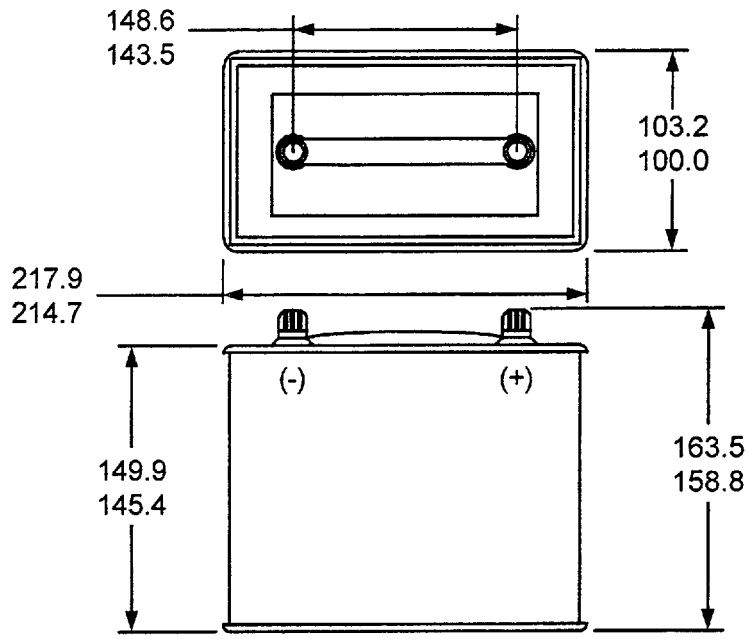
NOTE—Terminals: No. 8-32 terminal posts with knurl nuts. See 1.4.3.5.	

Designation	ANSI	903	
	IEC	---	
Electrochemical system		Carbon zinc	
Nominal voltage		7.5	
Maximum off-load voltage		9.0	
Performance after 12 months		80%	

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration	
Portable lighting	2.7	30 min/hr 8 hr/day	4.5	4.5 hr	

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	904



Millimeters	Inches	Millimeters	Inches
100.0	3.937	149.9	5.902
103.2	4.063	158.8	6.252
143.5	5.650	163.5	6.437
145.4	5.724	214.7	8.453
148.6	5.850	217.9	8.579

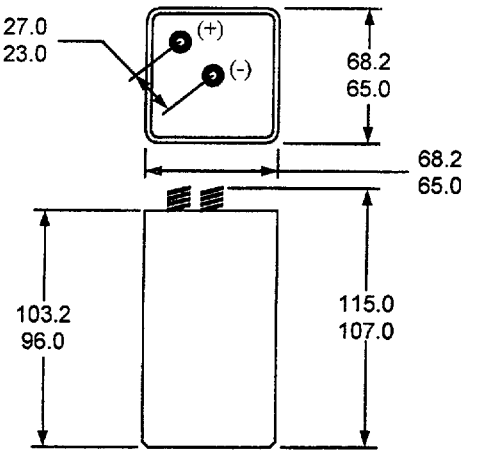
NOTE—Terminals: No. 8-32 terminal posts with knurl nuts. See 1.4.3.5.

Designation	ANSI	904
	IEC	---
Electrochemical system		Carbon zinc
Nominal voltage		9.0
Maximum off-load voltage		10.8
Performance after 12 months		80%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration
Portable lighting	3.3	30 min/hr 8 hr/day	5.4	4.5 hr

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	908



Millimeters	Inches
23.0	0.906
27.0	1.063
65.0	2.559
68.2	2.685
96.0	3.780
103.2	4.063
107.0	4.213
115.0	4.528

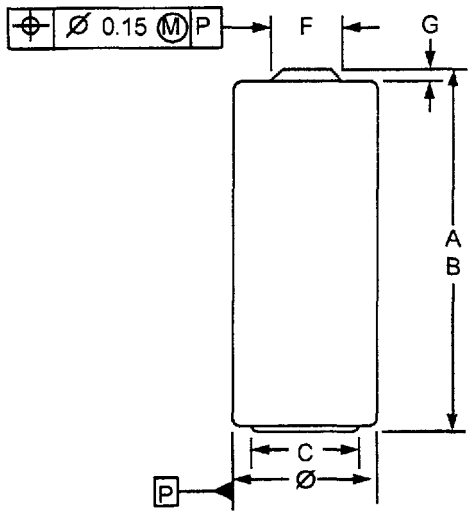
NOTES
1. Terminals: Spring (see 1.4.3.6)
2. This battery, with rounded or beveled corners, shall pass freely through a gauge having a diameter of 82.6 mm (3.250 in).

Designation	ANSI	908A 908AC	908	908C 908CD	908D
	IEC	4LR25X	4R25X	4R25X	4R25X
Electrochemical system		Alkaline manganese dioxide	Carbon zinc	Carbon zinc	Carbon zinc
Nominal voltage		6	6	6	6
Maximum off-load voltage		6.6	7.2	7.2	7.2
Performance after 12 months		90%	80%	80%	80%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration			
Portable lighting	9.1	30 min/hr 8 hr/day	3.6	21 hr	4.5 hr	5 hr	5 hr
Portable lighting	33	30 min/hr 8 hr/day	3.6	80 hr	35 hr	40 hr	50 hr
Steady burn barricade	110	12 hr/day	3.6	300 hr	155 hr	155 hr	165 hr

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	910



Dimension	Millimeters	Inches
A (Max)	30.2	1.189
B (Min)	29.1	1.146
C (Min)	5.0	0.197
F (Max)	4.7	0.185
G (Min)	0.5	0.020
Ø (Max)	12.0	0.472
Ø (Min)	10.9	0.429

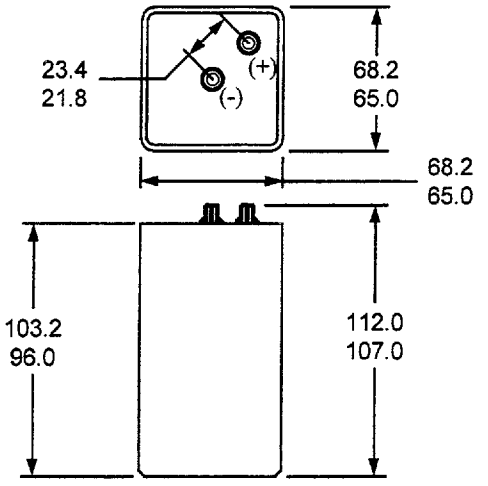
NOTE—Terminals: Cap and base	Small battery

Designation	ANSI	910A
	IEC	LR1
Electrochemical system		Alkaline manganese dioxide
Nominal voltage		1.5
Maximum off-load voltage		1.65
Performance after 12 months		90%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration
Portable Lighting	5.1	5 min/day	0.9	100 min
Pager	10 Ω--5 sec/hr, then 3 KΩ --3,595 sec/hr		0.9	888 hr

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	915



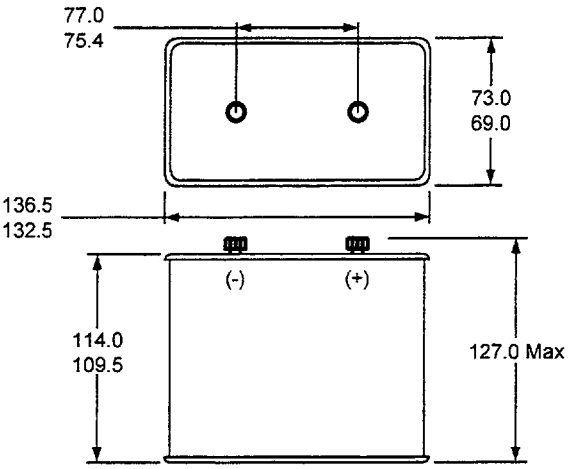
Millimeters	Inches	Millimeters	Inches
21.8	0.858	96.0	3.780
23.4	0.921	103.2	4.063
65.0	2.559	107.0	4.213
68.2	2.685	112.0	4.409

NOTES
1. Terminals: No. 8-32 terminal post with knurl nuts. See 1.4.3.5.
2. This battery, with rounded or beveled corners, shall pass freely through a gauge having a diameter of 82.6 mm (3.250 in).

Designation				**ANSI**	**915A 915AC**	**915 915C 915D**
				IEC	4LR25Y	4R25Y
Electrochemical system					Alkaline manganese dioxide	Carbon zinc
Nominal voltage					6	6
Maximum off-load voltage					6.6	7.2
Performance after 12 months					90%	80%
ANSI Designations					**915A 915AC**	**915 915C 915D**
Typical use	**Load (ohms)**	**Daily period**	**End point V**	**Minimum average duration**		
Portable lighting	9.1	30 min/hr 8 hr/day	3.6	21 hr	4.5 hr	
Portable lighting	33	30 min/hr 8 hr/day	3.6	80 hr	35 hr	

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	918



Millimeters	Inches	Millimeters	Inches
69.0	2.717	114.0	4.488
73.0	2.874	127.0	5.000
75.4	2.969	132.5	5.217
77.0	3.031	136.5	5.374
109.5	4.311		

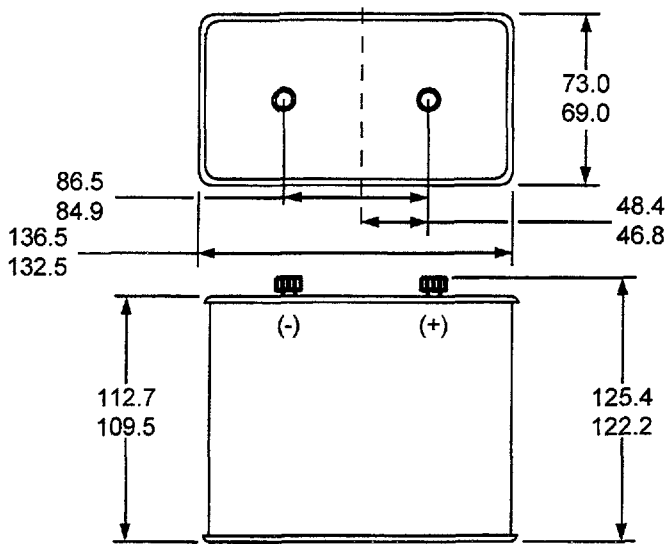
NOTE—Terminals: No. 8-32 terminal post with knurl nuts. See 1.4.3.5.	

Designation	ANSI	918A 918AC	918	918D	
	IEC	4LR25-2	4R25-2	4R25-2	
Electrochemical system		Alkaline manganese dioxide	Carbon zinc	Carbon zinc	
Nominal voltage		6	6	6	
Maximum off-load voltage		6.6	7.2	7.2	
Performance after 12 months		90%	80%	80%	

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration			
Portable lighting	9.1	30 min/hr 8 hr/day	3.6	60 hr	15 hr	20 hr	

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	926



Millimeters	Inches	Millimeters	Inches	Millimeters	Inches
46.8	1.843	86.5	3.406	122.2	4.811
48.4	1.906	84.9	3.343	125.4	4.937
69.0	2.717	109.5	4.311	132.5	5.217
73.0	2.874	112.7	4.437	136.5	5.374

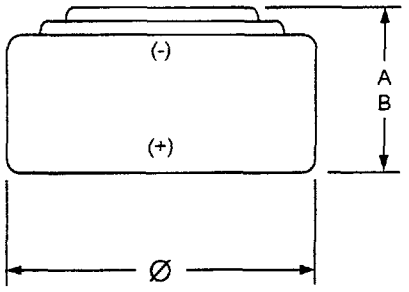
NOTE—Terminals: No. 8-32 terminal posts with knurl nuts. See 1.4.3.5.	

Designation	ANSI	926AC	926	
	IEC	---	---	
Electrochemical system		Alkaline manganese dioxide	Carbon zinc	
Nominal voltage		12	12	
Maximum off-load voltage		13.2	14.4	
Performance after 12 months		90%	80%	

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration		
Portable lighting	18	30 min/hr 8 hr/day	7.2	40 hr	7 hr	

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1107, 1131, 1166, 1184, 7003



Dimensions	Millimeters	Inches
A (Max)	5.4	0.213
B (Min)	5.0	0.197
Ø (Max)	11.6	0.457
Ø (Min)	11.25	0.443

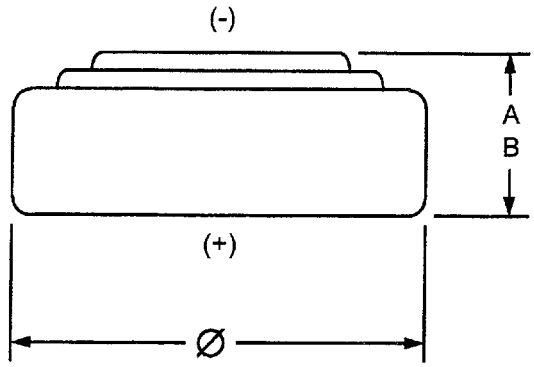
NOTE—Terminals: Cap and case	Small battery

Designation	ANSI	1166A	1131SO	1107SOP 1184SO	7003ZD
	IEC	LR44	SR44	SR44	PR44
Electrochemical system		Alkaline manganese dioxide	Silver oxide	Silver oxide	Zinc air
Nominal voltage		1.5	1.5	1.5	1.4
Maximum off-load voltage		1.65	1.63	1.63	1.68
Performance after 12 months		90%	90%	90%	95%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration			
Hearing Aid	620	12 hr	1.1	---	63 hr	---	189 hr
Hearing Aid	620	12 hr	1.0	---	65 hr	---	195 hr
Rating	6.8K	24 hr	1.2	500 hr	750 hr	650 hr	---

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1132, 1133



Dimensions	Millimeters	Inches
A (Max)	4.2	0.165
B (Min)	3.8	0.150
Ø (Max)	11.6	0.457
Ø (Min)	11.25	0.443

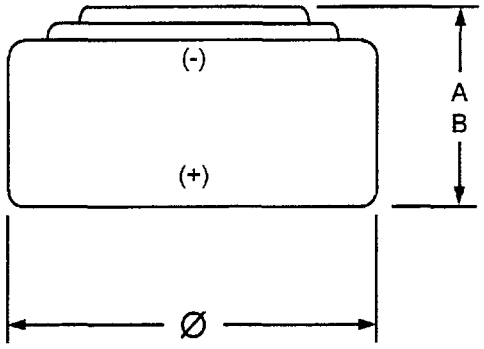
NOTES - Terminals: Cap and case	Small Battery

Designation	ANSI	1132SO	1133SO	
	IEC	SR43	SR43	
Electrochemical system		Silver oxide		
Nominal voltage		1.5	1.5	
Maximum off-load voltage		1.63	1.63	
Performance after 12 months		90%	90%	

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration		
Rating	10K	24 hr	1.2	620 hr	620 hr	

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1134, 1135, 1179, 7002



Dimensions	Millimeters	Inches
A (Max)	3.6	0.142
B (Min)	3.25	0.128
Ø (Max)	7.9	0.311
Ø (Min)	7.55	0.297

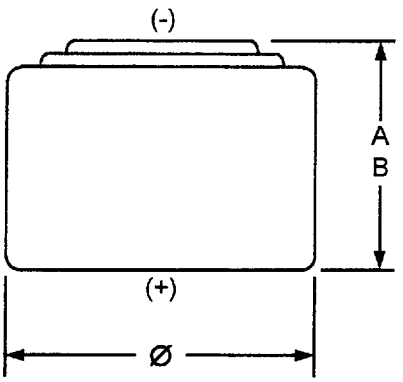
NOTE—Terminals: Cap and case	Small Battery

Designation	ANSI	1134SO	1135SO	1179SO	7002ZD
	IEC	SR41	SR41	SR41	PR41
Electrochemical system		Silver oxide			Zinc air
Nominal voltage		1.5	1.5	1.5	1.4
Maximum off-load voltage		1.63	1.63	1.63	1.68
Performance after 12 months		90%	90%	90%	95%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration			
Hearing aid	1.5K	12 hr	1.1	---	---	34 hr	97 hr
Hearing aid	1.5K	12 hr	1.0	---	---	35 hr	100 hr
Rating	22K	24 hr	1.2	450 hr	450 hr	---	---

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1136, 1137, 1181, 7000



Dimensions	Millimeters	Inches
A (Max)	5.4	0.213
B (Min)	5.0	0.197
Ø (Max)	7.9	0.311
Ø (Min)	7.55	0.297

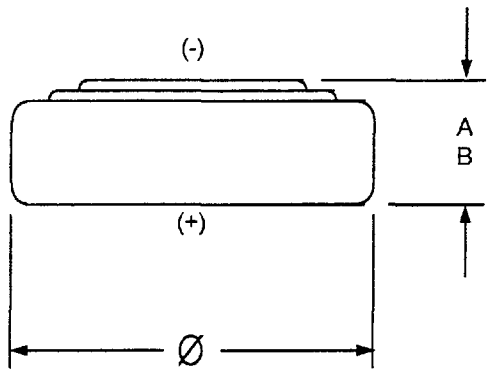
NOTE—Terminals: Cap and case	Small Battery

Designation	ANSI	1136SO	1137SO	1181SO	7000ZD
	IEC	SR48	SR48	SR48	PR48
Electrochemical system		Silver oxide			Zinc air
Nominal voltage		1.5	1.5	1.5	1.4
Maximum off-load voltage		1.63	1.63	1.63	1.68
Performance after 12 months		90%	90%	90%	95%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration			
Hearing aid	1.5K	12 hr	1.1	---	---	58 hr	189 hr
Hearing aid	1.5K	12 hr	1.0	---	---	60 hr	195 hr
Rating	15K	24 hr	1.2	580 hr	720 hr	---	---

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1138



Dimensions	Millimeters	Inches
A (Max)	3.05	0.120
B (Min)	2.75	0.108
Ø (Max)	11.6	0.457
Ø (Min)	11.25	0.443

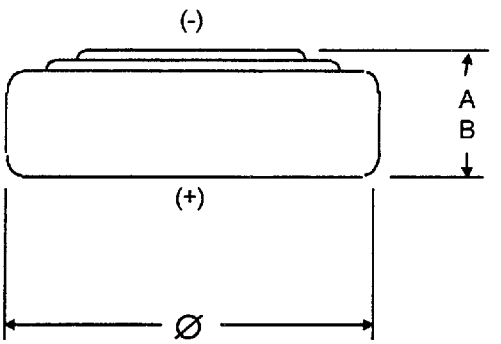
NOTE—Terminals: Cap and case	Small battery

Designation	ANSI	1138SO
	IEC	SR54
Electrochemical system		Silver oxide
Nominal voltage		1.5
Maximum off-load voltage		1.63
Performance after 12 months		90%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration
Rating	15K	24 hr	1.2	720 hr

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1139



Dimensions	Millimeters	Inches
A (Max)	3.6	0.142
B (Min)	3.3	0.130
Ø (Max)	11.6	0.457
Ø (Min)	11.25	0.443

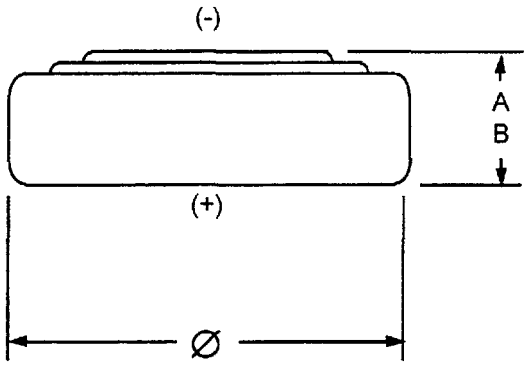
NOTE—Terminals: Cap and case	Small battery

Designation	**ANSI**	**1139SO**
	IEC	SR42
Electrochemical system		Silver oxide
Nominal voltage		1.5
Maximum off-load voltage		1.63
Performance after 12 months		90%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration
Rating	15K	24 hr	1.2	750 hr

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1158



Dimensions	Millimeters	Inches
A (Max)	2.1	0.083
B (Min)	1.85	0.073
∅ (Max)	7.9	0.311
∅ (Min)	7.55	0.297

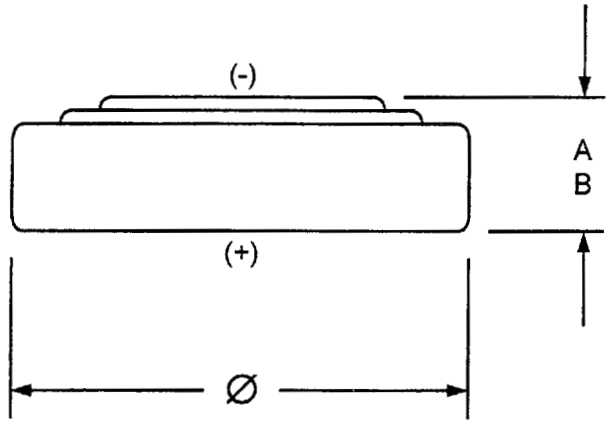
NOTE—Terminals: Cap and case	Small battery

Designation	ANSI	1158SO
	IEC	SR58
Electrochemical system		Silver oxide
Nominal voltage		1.5
Maximum off-load voltage		1.63
Performance after 12 months		90%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration
Rating	47K	24 hr	1.2	518 hr

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1160, 1170



Dimensions	Millimeters	Inches
A (Max)	2.1	0.083
B (Min)	1.85	0.073
Ø (Max)	11.6	0.457
Ø (Min)	11.25	0.443

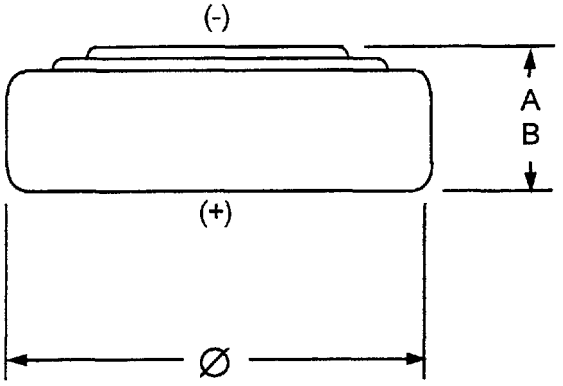
NOTE—Terminals: Cap and case	Small battery

Designation	ANSI	1160SO	1170SO	
	IEC	SR55	SR55	
Electrochemical system		Silver oxide	Silver oxide	
Nominal voltage		1.5	1.5	
Maximum off-load voltage		1.63	1.63	
Performance after 12 months		90%	90%	

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration		
Rating	22K	24 hr	1.2	450 hr	450 hr	

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1162, 1165



Dimensions	Millimeters	Inches
A (Max)	2.7	0.106
B (Min)	2.4	0.094
∅ (Max)	9.5	0.374
∅ (Min)	9.15	0.360

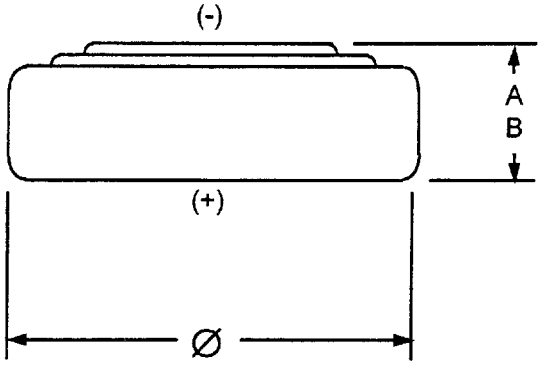
NOTE—Terminals: Cap and case	Small battery

Designation	ANSI	1162SO	1165SO
	IEC	SR57	SR57
Electrochemical system		Silver oxide	Silver oxide
Nominal voltage		1.5	1.5
Maximum off-load voltage		1.63	1.63
Performance after 12 months		90%	90%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration	
Rating	22K	24 hr	1.2	500 hr	650 hr

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1163, 1164



Dimensions	Millimeters	Inches
A (Max)	2.6	0.103
B (Min)	2.3	0.091
Ø (Max)	7.9	0.311
Ø (Min)	7.55	0.297

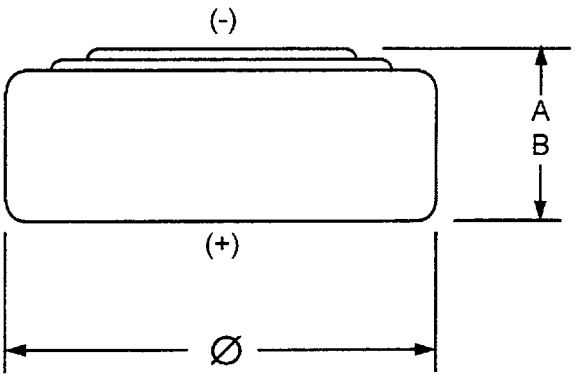
NOTE—Terminals: Cap and case	Small battery

Designation	ANSI	1163SO	1164SO	
	IEC	SR59	SR59	
Electrochemical system		Silver oxide	Silver oxide	
Nominal voltage		1.5	1.5	
Maximum off-load voltage		1.63	1.63	
Performance after 12 months		90%	90%	

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration		
Rating	33K	24 hr	1.2	600 hr	600 hr	

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1175



Dimensions	Millimeters	Inches
A (Max)	2.15	0.085
B (Min)	1.9	0.075
∅ (Max)	6.8	0.268
∅ (Min)	6.5	0.256

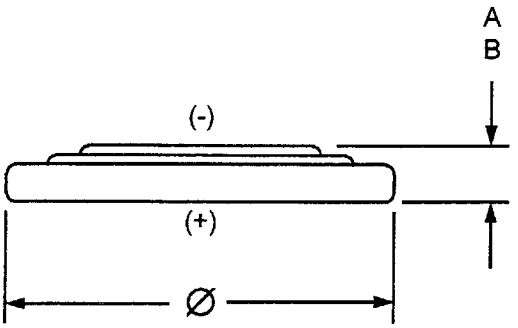
NOTE—Terminals: Cap and case	Small battery

Designation	ANSI	1175SO
	IEC	SR60
Electrochemical system		Silver oxide
Nominal voltage		1.5
Maximum off-load voltage		1.63
Performance after 12 months		90%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration	
Rating	68K	24 hr	1.2	685 hr	

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1177



Dimensions	Millimeters	Inches
A (Max)	1.6	0.063
B (Min)	1.35	0.053
∅ (Max)	11.6	0.457
∅ (Min)	11.25	0.443

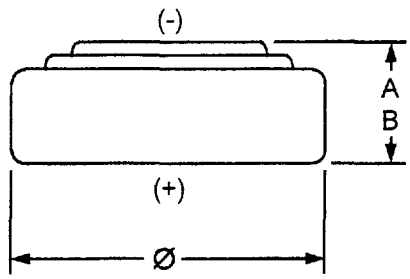
NOTE—Terminals: Cap and case	Small battery

Designation	ANSI	1177SO
	IEC	---
Electrochemical system		Silver oxide
Nominal voltage		1.5
Maximum off-load voltage		1.63
Performance after 12 months		90%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration	
Rating	30K	24 hr	1.2	585 hr	

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1191, 7012



Dimensions	Millimeters	Inches
A (Max)	2.15	0.085
B (Min)	1.9	0.075
Ø (Max)	5.8	0.228
Ø (Min)	5.55	0.219

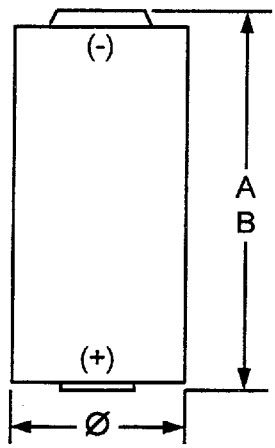
NOTE—Terminals: Cap and case	Small battery

Designation	ANSI	1191SO	7012Z
	IEC	SR63	---
Electrochemical system		Silver oxide	Zinc air
Nominal voltage		1.5	1.4
Maximum off-load voltage		1.63	1.68
Performance after 12 months		90%	95%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration	
Hearing aid	6.5K	12 hr	1.1	---	135 hr
Hearing aid	6.5K	12 hr	1.0	---	140 hr
Rating	68K	24 hr	1.2	500 hr	---

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1406, 1414



Dimensions	Millimeters	Inches
A (Max)	25.2	0.992
B (Min)	23.9	0.941
Ø (Max)	13.0	0.512
Ø (Min)	12.0	0.472

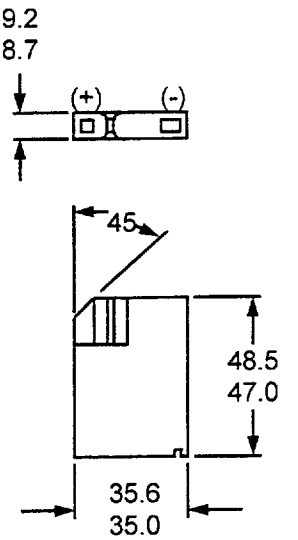
NOTE—Terminals: Flat contact	Small battery

Designation	ANSI	1406SOP	1414A
	IEC	4SR44	4LR44
Electrochemical system		Silver oxide	Alkaline manganese dioxide
Nominal voltage		6	6
Maximum off-load voltage		6.52	6.6
Performance after 12 months		90%	90%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration	
Rating	27K	24 hr	3.6	620 hr	620 hr

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1412



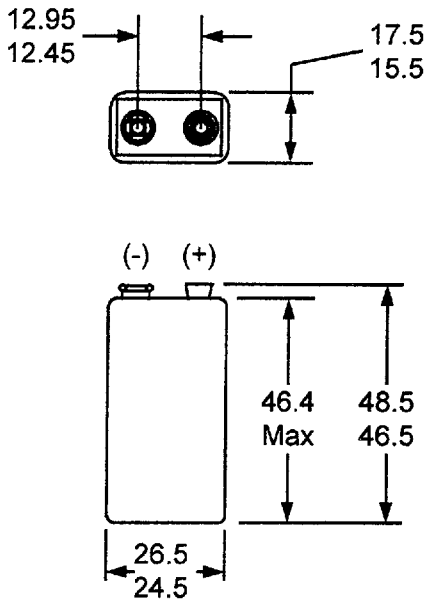
Millimeters	Inches
8.7	0.342
9.2	0.362
35.0	1.378
35.6	1.402
47.0	1.850
48.5	1.909

Designation	ANSI	1412AP
	IEC	4LR61
Electrochemical system		Alkaline manganese dioxide
Nominal voltage		6
Maximum off-load voltage		6.6
Performance after 12 months		90%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration	
Electronic equipment	330	24 hr	3.6	25 hr	
Rating	6.8K	24 hr	3.6	650 hr	

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	1604, 7004



Millimeters	Inches
12.45	0.490
12.95	0.510
15.5	0.610
17.5	0.689
24.5	0.965
26.5	1.043
46.4	1.827
46.5	1.831
48.5	1.909

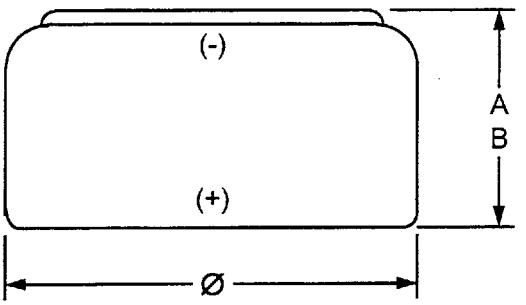
NOTE—Terminals: Snap

Designation	ANSI	1604A 1604AC	1604 1604C	1604D 1604CD	7004Z
	IEC	6LR61	6F22	6F22	---
Electrochemical system		Alkaline manganese dioxide	Carbon zinc		Zinc air
Nominal voltage		9	9	9	8.4
Maximum off-load voltage		9.9	10.8	10.8	10.8
Performance after 12 months		90%	80%	80%	95%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration			
Calculator	180	30 min	4.8	630 min	300 min	380 min	---
Toy	270	1 hr	5.4	14 hr	7 hr	9 hr	---
Transistor Radio	620	2 hr	5.4	38 hr	23 hr	24 hr	---
Electronic	1300	24 hr	6	---	---	---	160 hr
Smoke Detector	Under consideration						---

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	7005



Dimensions	Millimeters	Inches
A (Max)	3.6	0.142
B (Min)	3.3	0.130
Ø (Max)	5.8	0.228
Ø (Min)	5.6	0.220

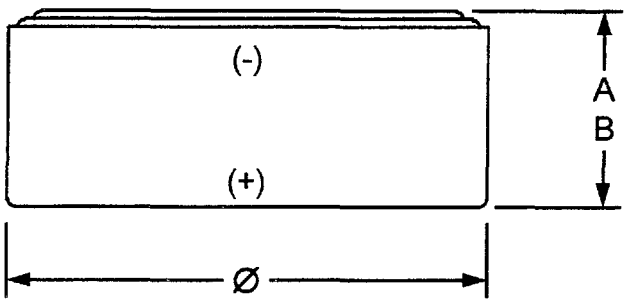
NOTE—Terminals: Cap and case	Small battery

Designation	ANSI	7005ZD
	IEC	PR70
Electrochemical system		Zinc air
Nominal voltage		1.4
Maximum off-load voltage		1.68
Performance after 12 months		95%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration	
Hearing aid	3000	12 hr	1.1	111 hr	
Hearing aid	3000	12 hr	1.0	115 hr	

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

ANSI C18.1M, Part 1-1999	BATTERY SPECIFICATION	7007



Dimensions	Millimeters	Inches
A (Max)	6.2	0.244
B (Min)	5.8	0.228
Ø (Max)	15.6	0.614
Ø (Min)	15.4	0.606

NOTE—Terminals: Cap and case	Small battery

Designation	**ANSI**	**7007Z**
	IEC	---
Electrochemical system		Zinc air
Nominal voltage		1.4
Maximum off-load voltage		1.68
Performance after 12 months		95%

Typical use	Load (ohms)	Daily period	End point V	Minimum average duration
Pager	330	24 hr	1.0	230 hr

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS
Not for Resale

Annex A
(informative)

Methods of determining load and test conditions

A.1 Application tests

a) The discharge load is calculated from the average current and average operating voltage of the most popular representative equipment.

b) The functional end point voltage and the discharge load value are obtained from the data on all the equipment measured.

c) The median class defines the discharge load value and the end point voltage to be used for the discharge test.

d) If the data are concentrated in two or more widely separated groups, more than one test may be required.

e) The daily discharge period should reflect typical consumer use.

f) In order to minimize the proliferation of application tests, the tests specified should be those accounting for 80% of the market by battery size with a limited number of tests.

g) Application tests should be used unless they require an excessive amount of time to run.

A.2 Capacity or rating tests

For capacity/rating tests, the value of the discharge load shall be selected such that the service output approximates 30 days.

When full capacity is not realized within the required time period, the service output may be extended to the shortest suitable duration thereafter by selecting a more appropriate discharge load.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

Annex B
(informative)

Guidance for packaging, handling, storage, and transportation

B.1 Introduction

The greatest satisfaction to the user of primary batteries results from a combination of good practices during manufacture, distribution, and use. The purpose of this code is to describe these good practices in general terms and, more specifically, to warn against procedures known from experience to be undesirable. It takes the form of advice to battery manufacturers, distributors, equipment designers, and users.

B.2 Packing

The packing should be adequate to avoid mechanical damage during transport, handling, and stacking. The materials and pack design should be chosen so as to prevent the development of unintentional electrical conduction, corrosion of the terminals, and ingress of moisture.

B.3 Transport and handling

Shock and vibration should be kept to a minimum. For instance, boxes should not be thrown off trucks, slammed into position, or piled so high as to overload battery containers below. Protection from inclement weather should be provided.

B.4 Storage and stock rotation

B.4.1 For normal storage, the temperature should be between +10° C and +25° C and never exceed +30° C. Batteries should therefore not be stored next to radiators or boilers nor in direct sunlight. Extremes of humidity (below 35% and above 95% relative humidity) for sustained periods should be avoided since they are detrimental to both batteries and packing.

B.4.2 Although the storage life of batteries at room temperature is good, storage is improved at lower temperatures, provided special precautions are taken. The batteries should be enclosed in special protective packing (such as sealed plastic bags or variants) which should be retained to protect them from condensation during the time they are warming to ambient temperature. Also, accelerated warming is harmful.

B.4.3 Batteries may be stored while fitted in equipment or packages if determined suitable by the battery manufacturer.

B.4.4 Batteries should be shipped promptly after manufacture. In order to practice stock rotation (first-in, first-out), storage areas and displays should be properly designed and packs adequately marked.

B.5 Display and sales points

B.5.1 When batteries are unpacked, care should be taken to avoid physical damage and accidental discharge.

B.5.2 The battery manufacturer should provide some information to assist the retailer in selecting the correct battery for the user's application.

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

Annex C
(informative)

Reliability guidelines

C.1 Consumer/user

In order to assure that batteries and appliances operate reliably, the following should be taken into consideration:

a) Since batteries are sensitive to high temperature, when storing them, keep them in a cool dry place.
b) Battery contacts need to be clean, both on the battery and in the appliance.
c) Batteries should be removed from the appliance when not being used for long periods of time (months).
d) Choose the proper battery for the intended application. Follow the recommendations supplied with the appliance.
e) Never charge a battery unless the battery label specifically states that it is a rechargeable battery.
f) Use the power cord supplied with the appliance since the use of other cords may result in the batteries in the appliance being charged.

C.2 The designer

The following are considerations for the designer:

a) Choose the proper battery for the intended application.
b) Never solder or weld to a battery without first contacting the manufacturer for advice.
c) The choice of contact material and the type of contact mechanism will affect the reliability of the appliance/device being designed.
d) Pressure contacts require a special knowledge of contact materials, corrosion couples, connection force, point connections, corrosion inhibitors, etc.
e) Care should be taken to avoid battery damage during ultrasonic sealing.
f) Once sample units are developed, high temperature and humidity tests should be performed to test for contact integrity.
g) Care should be taken to avoid battery damage during ultrasonic sealing.
h) Battery compartment contacts should be designed to prevent reverse battery installation.

Previous page is blank

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale

Annex D
(informative)

Bibliography

ANSI/IEEE 268, *American national standard metric practice*

IEC 60086-1, *Primary batteries, Part 1: General*

IEC 60086-2, *Primary batteries, Part 2: Specification sheets*

Previous page is blank

Copyright National Electrical Manufacturers Association
Provided by IHS under license with NEMA
No reproduction or networking permitted without license from IHS

Not for Resale