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Specification for Dry Cells and Batteries

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Specification for Dry Cells and Batteries

By

Sectional Committee on Dry Cells and Batteries—C18

Under the Sponsorship of the
National Bureau of Standards

Approved August 19, 1954, as American Standard, by the
American Standards Association (ASA designation C18.1–1954, UDC 621.352.7)

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Preface

The sixth edition of the American Standard Specification for Dry Cells and Batteries contained in this Circular was approved as American Standard on August 19, 1954. It supersedes the previous specification, which was approved August 6, 1947, and published in Circular 466 of the National Bureau of Standards.

The publication of this revision of the American Standard Specification for Dry Cells and Batteries marks the completion of another step in the development of a specification that had its inception in the need for a purely governmental standard during the critical years of 1917 and 1918. Since then, manufacturers of dry cells and large industrial users have cooperated with representatives of the Government in perfecting tests and specifications for the varied kinds of dry cells and batteries. This work has been accomplished through a Sectional Committee of the American Standards Association, acting under the sponsorship of the National Bureau of Standards.

Within the past few years new types of cells have been developed to meet new industrial uses, and the available electrical output of better brands of the older types has been materially increased. Successive editions of this specification have reflected these changes. This edition of the specification includes for the first time specifications on flat cells and new alkaline primary cells known as "mercury cells"; previous editions were confined to cylindrical Leclanché types. Mercury cells were produced initially during World War II for military applications and later on found commercial use principally in hearing-aid instruments. Also, air-depolarized cells in miniature size that have been developed as replacements for other types of dry cells used in hearing-aid instruments are covered by the present revision of the American Standard.

Advances in the dry-battery industry were made possible by the ability and willingness of battery manufacturers to improve the quality of their product and devise new methods of assembling the final units. The National Bureau of Standards cooperated with them in the tests, specifications, and some phases of research. The Bureau is pleased to have had a part in this work. The resulting benefits accrue to the Government and to the public alike. Future revisions of the specification will undoubtedly become necessary, as they have in the past, because the value of the specifications depends on their keeping pace with the advances made in the art.

A. V. Astin, *Director.*

History of the Project

In 1912 a committee [1] of the American Electrochemical Society recommended standard methods of testing dry cells. Although much has been accomplished in developing specifications for dry cells and batteries since that time, the influence of these early recommendations on some of the later specifications is still discernible.

The preparation of nationally recognized specifications to include sizes of cells, arrangement of batteries, tests, and required performance began in 1917 with the drafting of specifications which were later submitted by the National Bureau of Standards to a committee including representatives of manufacturers, the War Industries Board, and several Government Departments. The specifications which were approved at that time were published in 1919 as an appendix to the Bureau's Circular [2] on dry cells. Within a few years the need for revision became apparent and the Bureau was asked to call a conference of representatives of manufacturers, Government departments, and some of the largest individual users of dry cells. This conference met in December 1921 and agreed on a standardization program for sizes of cells and batteries, tests, and performance. New specifications were published in the second edition of the Bureau's Circular [3] on dry cells, and following their adoption as a Government standard they were issued separately.[4]

In 1924 a committee consisting of representatives of the Government, battery manufacturers, and several large users of dry cells agreed on a standard system of nomenclature for dry cells and batteries. This has been used in subsequent revisions of the specifications. This committee initiated a movement for a more representative and permanent organization to deal with subsequent revisions of the dry-cell specifications with the result that the American Engineering Standards Committee (now the American Standards Association) authorized the formation of a sectional committee on dry cells under the sponsorship of the National Bureau of Standards. This committee has been active since its organization in 1926 and has prepared six revisions of the specifications, which became American Standards in 1928,[5] 1930,[6] 1937,[7] 1941,[8] 1947,[9] and 1955.

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1 Trans. Am. Electrochem. Soc. **21,** 275 (1912).

2 Cir. BS 79, p. 39 (1919).

3 Cir. BS 79, 2d ed., p. 54 (1923).

4 Cir. BS 139 (1923); U. S. Government Standard Specification No. 58.

5 Cir. BS 139, 2d ed. (1927); U. S. Government Master Specification No. 58a; ASA Standard C18-1928.

6 Cir. BS 390 (1930); ASA Standard C18-1930.

7 Cir. BS 414 (1937); ASA Standard C18-1937.

8 Cir. NBS 435; ASA Standard C18-1941.

9 Cir. NBS 466; ASA Standard C18-1947.

Close cooperation has been maintained between this sectional committee and the technical committee on dry cells reporting to the Federal Specifications Board, with the result that Federal specifications issued in 1931,[10] 1935,[11] and 1948 [12] have been concordant with the American Standard specification, although differing in form. The 1935 specification anticipated many of the changes incorporated in the 1937 American Standard but did not include batteries intended primarily for use with hearing-aid devices. The Federal Specification was revised again in 1954.

Periodic revision of the American Standard specifications becomes necessary as a result of changes in the art. New types and uses for batteries require the drafting of new specifications, and the improved performance of batteries justifies some increase in the requirements. The new specifications, therefore, reflect the advances in the dry-battery industry, and the present Circular for the first time contains other types of dry cells which have been developed and manufactured during the past few years. The so-called "mercury cells" were developed and manufactured during World War II for military service and now are available to the public principally in connection with hearing-aid instruments. Specifications for several standard sizes and types are given in this Circular. There also have been some developments in the so-called "air-depolarized" cells, which were made before World War II. These types have been designed especially in small sizes for hearing-aid instruments and are listed in this Circular as equivalent in size and capacity to some of the mercury cells. Another type of cell construction not previously listed in the specification is the flat-cell, which has found general application to B-battery circuits in portable radio receivers, and also has been miniaturized for hearing-aid instruments. New tests for such miniature batteries, used in these instruments for both A and B circuits, have been included in this Circular, together with test-performance requirements.

Photoflash cells, intended for special use with photoflash lamps, have been developed and used for several years. These cells are of the standard sizes listed in this Circular, but are of special composition and intended to give better service than the ordinary flashlight cells. A special test for this type of cell has been included in the Circular, together with test-performance requirements.

Some of the advances made in the performance of batteries during the past years may be judged from the examples listed in the following paragraphs and taken from a paper by Gillingham.[13] Gillingham's performance figures relate to the better brands available at the time, but are not necessarily confined to the product of any particular manufacturer.

The spontaneous shelf deterioration of dry cells of the ordinary No. 6 size for general purposes, occurring in 6 months, was reduced from 35 percent in 1901 to 25 percent in 1916 and to 7 percent in 1934. Since the publication of Gillingham's paper in 1935 the shelf deterioration as observed from tests made during 1950–51 on a number of brands has been further reduced to about 2 percent.

[10] Federal Standard Stock Catalog, Specification Symbol W–B–101 (March 31, 1931).
[11] Federal Standard Stock Catalog, Specification Symbol W–B–101a (May 7, 1935).
[12] Federal Standard Stock Catalog, Specification Symbol W–B–101b (February 19, 1948).
[13] Trans. Electrochem. Soc. 68, 159 (1935).

The useful output of dry cells, measured by their service life on various tests, described in the accompanying specifications, has been materially increased. Cells of the telephone type, made in 1910, gave 155 days of service on the light intermittent test; those made in 1916 gave 165 days and the output was increased in 1926 to 230 days. About 1930, special grades of telephone cells became available giving 360 days, and some cells in 1934 reached 450 days. Since then no material change in service life of these cells has been noted.

In 1910, flashlight cells of the D size gave 260 minutes of service on the 4-ohm intermittent test, but in 1934, cells of this type yielded as high as 750 minutes. In the 1950–51 qualification test, the average service on this test, as observed from results obtained on 12 to 15 brands tested, was about 800 minutes, with some types giving 1,000 and 1,100 minutes.

Industrial flashlight cells, intended for heavier service than the ordinary flashlight cells, appeared on the market about 1930, at which time they gave 250 minutes of service on the heavy-industrial test. Subsequent improvements were made rapidly, with the result that 975 minutes of service on the same test were obtainable from cells made in 1935. Results obtained in 1950–51 indicate that no appreciable change has taken place in connection with the heavy-industrial flashlight cell. However, some cells for light-industrial service show results from 1,000 to 1,200 minutes.

Radio B batteries, which appeared about 1918, gave 377 hours on the 5,000-ohm continuous test, but in 1926, batteries containing the same size of cell gave 1,000 hours, and this was increased to 1,500 hours of service from batteries made in 1934. No further improvement in radio B batteries as observed on continuous tests have been recorded after 1934 because all continuous tests on B batteries were abolished and replaced by intermittent tests, which are more nearly representative of service conditions.

Hearing-aid batteries (CD size) gave 18 hours of service in 1932. In 1935, similar batteries gave 50 hours of service, whereas in 1953–54 some brands gave 65 to 75 hours. Some further developments have been made in hearing-aid B batteries, which are used with vacuum-tube-type instruments. These batteries are much smaller than any previously made and give good service at low current drains, even after 6 months of storage at normal temperatures.

These examples illustrate improvements that are the result of organized research and development on the part of the manufacturers and of standardized test procedures and specifications attained through cooperation of the groups represented on the sectional committee. To allow for manufacturing variations and to obtain adequate competition, it is necessary that the minimum required performance of the various types and sizes of cells included in the specifications be somewhat less than the maximum figures quoted above. The proportion of poorer brands on the market has decreased during the past few years. The result of all these factors has been a considerable gain to the public at large.

The present revision of this specification was completed under the supervision of John P. Schrodt of the National Bureau of Standards, who served as Chairman of the Sectional Committee on Dry Cells and Batteries—C18, until December 1954, at which time Mr. Schrodt retired from the staff of the Bureau.

Personnel of Sectional Committee

The personnel of the Sectional Committee on Dry Cells and Batteries—C18 is as follows:

Organization Represented	Name and Business Affiliation
American Institute of Electrical Engineers.	W. B. Kouwenhoven, Johns Hopkins University, Baltimore 18, Md.
American Hearing Society.	Douglas Macfarlan, M. D., Philadelphia, Pa. (resigned, successor to be appointed).
ASA Sectional Committee on Acoustical Measurements and Terminology Z24.	H. A. Carter, American Medical Association, Chicago 10, Ill.
ASA Sectional Committee on Radio, C16.	F. T. Bowditch, National Carbon Co., Cleveland 1, Ohio.
Association of American Railways, Signal Section.	T. T. Hart, Signal Eng., New York Central System, Springfield 3, Mass.
Association of American Railways, Communication Section.	H. W. Burwell, Louisville & Nashville RR, Louisville 1, Ky.
Bell Telephone Laboratories, Telephone Group, ASA.	J. H. Bower, Bell Telephone Laboratories, Murray Hill, N. J.
Bright Star Industries.	N. Richmond, Bright Star Industries, Clifton, N. J.
Burgess Battery Co.	J. J. Coleman, Burgess Battery Co., Freeport, Ill.
Electrical Testing Laboratories.	H. C. Koenig, Electrical Testing Laboratories, Inc., New York 21, N. Y.
Electrochemical Society.	C. C. Rose, Willard Storage Battery Co., Cleveland 1, Ohio.
General Dry Batteries, Inc.	C. G. Birdsall, General Dry Batteries, Inc., Cleveland 7, Ohio.
Independent Engineer.	W. B. Kouwenhoven, Johns Hopkins University, Baltimore 18, Md.
Marathon Battery Co.	G. H. Schroeder, Marathon Battery Co., Wausau, Wis.
National Bureau of Standards.	H. J. DeWane, W. J. Hamer (chairman of committee), U. S. Department of Commerce, National Bureau of Standards, Washington 25, D. C.
National Carbon Co.	F. J. Wolfe (secretary of committee), National Carbon Co., Cleveland 1, Ohio.
Department of the Navy.	Officer in Charge, Technical Societies Branch, Bureau of Ships, Department of the Navy, Washington 25, D. C.
Olin Industries, Inc.	F. A. Keller, Olin Industries, Inc., New Haven, Conn.
Radio Electronics Television Manufacturers Association.	L. M. Temple, Olin Industries, Inc., New Haven, Conn.
Ray-O-Vac Co.	R. E. Ramsay, Ray-O-Vac Co., Madison 10, Wis.

Contents

Specifications for Dry Cells and Batteries

American Standard C18.1–1954
(Revision of C18–1947)

1. Definitions

1.1. Dry cells and batteries to be included under this specification shall fulfill the following requirements in addition to those in other paragraphs of this specification.

The cells shall have a nonspillable electrolyte.

2. Nomenclature

2.1. For reference in this specification, the following systems of nomenclature shall be used to designate sizes and types.

2.2. Cells listed and designated in tables 1 and 2 are considered standard. These tables show nominal dimensions over the can for cylindrical cells, but the designations may apply also to cylindrical cells of other dimensions and to cells of other shapes, which, when used in assembled batteries, correspond approximately to the standard size in volume or electrical capacity rating. Such batteries shall be subject to standard dimensions and performance requirements.

Table 1. *Sizes of cylindrical cells*

Cell designation	Nominal dimensions		Approximate volume	Approximate weight
	Diameter	Height over can		
	Inches	*Inches*	*Cubic inches*	*Pounds*
No. 6	2½	6	29. 3	2. 2
J	1¼	5⅞	7. 2	. 6
G	1¼	4	4. 92	. 4
F	1¼	3 7/16	4. 22	. 35
D	1¼	2¼	2. 76	. 22
CD	1	3 3/16	2. 51	. 20
CL	15/16	2⅝	1. 81	. 13
C	15/16	1 13/16	1. 25	. 10
B	¾	2⅛	. 95	. 077
BR	¾	1½	. 66	. 046
BF	¾	1 5/16	. 58	. 04
A	⅝	1⅞	. 57	. 046
AA	17/32	1⅞	. 42	. 033
AAA	25/64	1 11/16	. 20	. 018
R	17/32	1 5/16	. 292	. 023
N	7/16	1 1/16	. 160	. 012
NS	7/16	¾	. 113	. 009
M1[a]	0. 625	0. 660	. [illegible]0	. 027
M3[a]	1. 000	. 660	. 50	. 057
M4[a]	1. 225	. 660	. 74	. 094
MA[a]	0. 625	1. 950	. 60	. 088
MAA[a]	. 546	1. 950	. 39	. 066

[a]M = Mercury type or equivalent size.

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TABLE 2. *Sizes of standard flat cells*

Cell designation	Nominal dimensions			Approximate volume
	Length	Width	Thickness	
	Inches	*Inches*	*Inch*	*Cubic inches*
F15	9/16	9/16	0.12	0.032
F20	15/16	17/32	.11	.055
F30	1 1/4	27/32	.13	.134
F40	1 1/4	27/32	.21	.217
F50	1 1/4	1 1/4	.14	.219
F60	1 1/4	1 1/4	.15	.235
F70	1 45/64	1 45/64	.22	.638
F80	1 11/16	1 11/16	.25	.713
F90	1 11/16	1 11/16	.31	.884
F100	2 3/8	1 25/32	.41	1.74

2.3. Assembled batteries are designated by a code system formulated as follows:

(1) The size of cell is indicated by the designation shown in tables 1 and 2.

(2) Preceding the size designation is a numeral showing the number of cells (or 1½-volt groups) in series in the battery. If no numeral appears, it is to be understood that the battery is a 1½-volt battery.

(3) Following the cell-size designation is a numeral indicating the number of cells or groups of cells connected in parallel. If no such parallel-indicating numeral appears, it is to be understood that the battery consists of only a single series group. If there is a possibility of confusion between a cell designation and a parallel-indicating numeral, a dash shall be used to separate them. Thus, 15G2 will represent a 22½-volt battery of 30 G-size cells connected in groups of 15 in series, 2 groups in parallel, and 15F100–2 will represent a series parallel battery of 30 F100-size cells.

(4) When a small letter "s" or "d" is used at the end of the code, it indicates either of two structural arrangements identical as to number and size of cells and electrical connections; "s" indicating a single, and "d" a double-row arrangement.

3. Nominal Voltages of Dry Batteries

Voltages in common use for dry-battery combinations are as follows:

1.5	9	45
3	15	67.5
4.5	22.5	90
6	30	300
7.5	33	

4. General Classification of Cells and Batteries

4.1. The following classes of dry cells and batteries are included in this specification:

(a) General-purpose No. 6 dry cells.
(b) Industrial No. 6 dry cells.
(c) Telephone cells, in No. 6, and D sizes.
(d) Assembled batteries of No. 6 cells.
(e) Group batteries of small cells, intended for No. 6 dry-cell applications.
(f) General-purpose flashlight cells.
(g) Industrial flashlight cells and batteries.
(h) Batteries for photoflash lamps.
(i) Batteries for hearing aids.
(j) A batteries.
(k) B batteries.
(l) C batteries.
(m) A/B battery packs.

5. Standard Sizes of Cells and Batteries

5.1. *No. 6 Dry Cells.* The dimensions for the zinc container of the cell measured without the jacket, are: Diameter, 2½ inches; height, 6 inches. Deviations shall not exceed 1/16 inch in diameter and ⅛ inch in height, from the dimensions as given. The over-all dimensions, including the jacket and terminals, shall not exceed: Height, 6¾ inches; diameter, 2⅝ inches.

5.2. *Assembled Batteries of No. 6 Cells.* Standard batteries of this class are shown with their required dimensions in table 3.

5.3. *Group Batteries of Small Cells (for No. 6 cell applications).* Cells contained in these batteries may be of various sizes, as preferred by the manufacturer. Batteries shall comply with the dimension requirements of table 4.

5.4. *Flashlight Cells and Batteries.* Those considered standard are listed in table 5, and shall comply with the dimensions shown therein.

Table 3. *Assembled batteries of No. 6 cells*

Battery designation	Number of cells in series	Arranged in—	Nominal battery voltage	Maximum dimensions		
				Length	Width	Height
			Volts	*Inches*	*Inches*	*Inches*
46s	4	1 row	6	10⅝	2¾	7½
46d	4	2 rows	6	5⅜	5⅜	7½
56d	5	do	7. 5	8	5⅜	7½
66d	6	do	9	8	5⅜	7½

Table 4. *Group batteries of small cells*
No 6. *cell applications*

Nominal battery voltage	Maximum dimensions		Overall height
	Length	Width	
Volts	*Inches*	*Inches*	*Inches*
1. 5	2⅝	2⅝	6¼
3	4	2¾	6¼
4. 5	4	4	6¼
6	2¾	8¼	6⅜
7. 5	4	7 5/16	6⅜
9	4	8½	6⅜

Table 5. *Flashlight cells and batteries*

Cell or battery designation	Maximum dimensions		Minimum dimensions	
	Diameter	Height	Diameter	Height
UNIT CELLS [a]				
	Inches	*Inches*	*Inches*	*Inches*
D	1 11/32	2 13/32	1 9/32	2 5/16
C	1 1/32	1 31/32	31/32	1⅞
BF	27/32	1 15/32	25/32	1⅜
AA	9/16	1 31/32	17/32	1 29/32
AAA	13/32	1¾	⅜	1 11/16
LANTERN BATTERY				
4F	[b] 3⅜	[c] 4	--------	3 13/16

[a] Cells may be supplied as tubular batteries as follows if required: 2D, 3D, 2C, 2BF, 2AA.
[b] Maximum diagonal. This battery must pass through a circle 3⅜ inches in diameter.
[c] Height over body, exclusive of terminals.

5.5. *Batteries for Hearing Aids.* These batteries are of several groups, according to the type of instrument for which they are intended, and are so arranged in table 6. Such batteries shall comply with dimensions listed in the table. Codes referring to the various batteries are described in section 2.3.

5.6. *A Batteries.* Standard types of A batteries are listed with dimension requirements in table 7. For descriptive code, see section 2.3 of this specification. A batteries are designed to supply filament current for vacuum tubes, especially in portable receivers.

5.7. *B Batteries.* These batteries are for vacuum-tube plate-current supply and are usually furnished in series-assembled units of 22½ volts and multiples thereof, as shown in table 8.

5.8. *C Batteries.* Standd artypes are listed with dimensions in table 9. They are intended to supply bias voltage to vacuum tubes.

TABLE 6. *Batteries for hearing aids*

Battery designation		Battery voltage (nominal)	Recommended terminal arrangement	Maximum dimensions			
Cylindrical	Flat			Diameter	Length	Width	Over-all height
PART I. A BATTERIES FOR VACUUM-TUBE INSTRUMENTS							
		Volts		*Inches*	*Inches*	*Inches*	*Inches*
AA	-----	1.5	Flat on cell	9/16	-----	-----	1 31/32
AA2	-----	1.5	do	-----	1 9/64	19/32	2 1/64
A	-----	1.5	do	41/64	-----	-----	2
C	-----	1.5	do	1 1/32	-----	-----	1 31/32
CL	-----	1.5	do	1 1/32	-----	-----	2 25/32
D	-----	1.5	do	1 11/32	-----	-----	2 13/32
CL	-----	1.5	I	1 3/32	-----	-----	3 7/16
CD	-----	1.5	I	1 1/8	-----	-----	4
F	-----	1.5	I	1 11/32	-----	-----	4 3/16
M1[a]	-----	1.35	Flat on cell	0.625	-----	-----	0.660
M3[a]	-----	1.35	do	1.000	-----	-----	.660
M4[a]	-----	1.35	do	1.225	-----	-----	.660
MA[a]	-----	1.35	do	0.625	-----	-----	1.95
MAA[a]	-----	1.35	do	.546	-----	-----	1.97
MAA2[a]	-----	1.25	do	-----	1 9/64	19/32	2 1/64
PART II. B BATTERIES FOR VACUUM-TUBE INSTRUMENTS							
-----	10F15	15	Flat projecting, one on each end.	-----	5/8	19/32	1 3/8
-----	15F15	22.5	Flat recessed, one on each end.	-----	5/8	19/32	2
-----	20F15s	30	Flat projecting, one on each end.	-----	5/8	19/32	2 39/64
-----	20F15d	30	Flat projecting, both on top.	-----	1 7/32	5/8	1 27/64
-----	10F20	15	XVI	-----	1 1/16	5/8	1 1/2
-----	15F20	22.5	XVI	-----	1 1/16	5/8	2
-----	20F20	30	XVI	-----	1 1/16	5/8	2 9/16
10NS	10F30	15	XVI	-----	1 3/8	1 1/16	1 9/16
15NS	15F30	22.5	XVI	-----	1 3/8	1 1/16	2 3/16
20NS	20F30	30	XVI	-----	1 3/8	1 1/16	2 13/16
15NS	15F30	22.5	VIII	-----	1 3/8	1 1/16	2 3/4
20NS	20F30	30	VIII	-----	1 3/8	1 1/16	3 3/8
15N	15F40	22.5	VIII	-----	1 13/32	1 1/16	4 1/32
22N	22F40	33	VIII	-----	2 21/32	1 1/16	3 1/8
30N	30F40	45	VIII	-----	2 21/32	1 1/16	4 1/32
PART III. BATTERIES FOR "CARBON"-TYPE INSTRUMENTS							
2CD		3	XVII	-----	2 3/16	1 3/16	4 1/8
3CD		4.5	XVII	-----	3 1/4	1 3/16	4 1/8

[a] M = Mercury type or equivalent size.

TABLE 7. *A batteries*

Battery designation	Battery voltage (nominal)	Terminal arrangement	Maximum dimensions		
			Length	Width	Body height
	Volts		*Inches*	*Inches*	*Inches*
F2	1.5	I	2 5/8	1 3/8	4 1/8
F4d	1.5	I	2 5/8	2 5/8	4 1/8
F6d	1.5	I	3 15/16	2 3/4	4 1/8
F8d	1.5	I	3 15/16	2 3/4	5 1/2
3D	4.5	III	3 15/16	1 5/16	2 15/16
3F	4.5	III	4	1 3/8	4 1/8
3G	4.5	III	4	1 3/8	4 3/4
4F2s	6	IV	3 15/16	1 7/16	10 7/8
4Fd	6	IV	2 21/32	2 21/32	4 1/4

TABLE 8. *B batteries*

Battery designation		Battery voltage (nominal)	Terminal arrangement	Maximum dimensions		
Cylindrical	Flat			Length	Width	Body height
		Volts		*Inches*	*Inches*	*Inches*
	15F20	22.5	XVI	1 1/16	5/8	2
	20F20	30	XVI	1 1/16	5/8	2 9/16
15NS	15F30	22.5	XVI	1 3/8	1 1/16	2 3/16
20NS	20F30	30	XVI	1 3/8	1 1/16	2 13/16
45NS	45F30	67.5	XV	2 13/16	1 3/8	2 7/16
30N	30F40	45	XV	2 21/32	1	3 11/16
45N	45F40	67.5	XV	2 13/16	1 3/8	3 23/32
60N	60F40	90	XV[a]	2 23/32	1 3/8	3 23/32
30AA	30F70	45	IX or X	3 1/8	2 3/8	4 3/16
30A	30F80	45	IX or X	3 9/16	2 5/16	4 5/8
15A	15F80	22.5	Screw	3 17/32	2 3/16	2 21/32
30BR	30F90	45	IX or X	3 5/8	1 27/32	5 5/8
30B	------	45	IX or X	4 3/8	2 11/16	5 1/2
15B	------	22.5	XII	4 1/4	2 5/8	3
	30F100	45	VII	5 1/8	2 1/16	7 1/4
30D	------	45	VII	8 1/4	3 5/16	7 3/8
30F	------	45	VII	8 1/4	4 1/2	7 3/8
30G	------	45	VII	8 1/4	4 9/16	7 3/8

[a] Spacing for snap terminals to be 2.5 inches, center to center, instead of 1.5 inches as shown.

TABLE 9. *C batteries*

Battery designation	Battery voltage (nominal)	Terminal arrangement	Maximum dimensions		
			Length	Width	Body height
	Volts		*Inches*	*Inches*	*Inches*
3B	4.5	Screw or flat-spring type	2 1/2	7/8	3
5B	7.5	([a])	4 1/4	15/16	3
15B	22.5	XII	4 1/4	2 5/8	3
3D	4.5	XI	4 1/16	1 1/2	3 1/16
200F20	300.0	XVIII	2 11/16	2 7/32	3 13/16

[a] One flexible-wire terminal at 7½ volts and 5 screw terminals.

5.9. *A/B Pack Batteries.* Batteries in this classification comprise suitable combination of A and B units assembled in a single battery. Standard types are listed with dimension requirements in table 10.

TABLE 10. *A/B pack batteries*

Battery designation	Battery voltage (nominal)		Terminal arrangement	Maximum dimensions		
	A	B		Length	Width	Body height
	Volts	*Volts*		*Inches*	*Inches*	*Inches*
60D/F18	1.5	90	XIII	16	4½	7$\frac{1}{16}$
60BR/6G	9 and 7½	90	XIV	10$\frac{9}{16}$	3⅜	4$\frac{5}{16}$
60A/6F	9 and 7½	90	XIV	9⅝	2⅞	4½
60AA/6CD	9 and 7½	90	XIV	8⅞	2⅛	3$\frac{25}{32}$

6. Material and Workmanship

6.1. Material and workmanship shall be first class in every particular. Cells or batteries having any of the following defects shall be considered as not complying with this part of the specification: Loose terminals, spring clips, or plug-in terminals that do not make and maintain positive connections to the external circuit, corrosion of terminals, loose or broken seals, leaking or distorted containers. Cells and assembled batteries shall be free from deformation and leakage during their useful life under specified test conditions.

7. Jackets

7.1. Single No. 6 dry cells and flashlight Leclanché type unit cells shall be enclosed in close-fitting jackets, usually of paperboard, but may be of plastic or other suitable material. For special purposes, jackets may be treated when so specified, with paraffin or other waterproofing material. When metal-clad jackets are provided on Leclanché-type unit cells, they shall be insulated from both terminals of the cell, and shall be covered outside with insulating material that is adherent and resistant to penetration by exposed metal switch parts of flashlights or other equipment in which the cells are used.

8. Marking

8.1. On the outside of the jackets of individual cells and outside of batteries shall be printed the following information:

The trade name of the cell or battery.

The name of the manufacturer or supplier, or such trade-mark as will identify him.

Number or other designation of size.

The coded date of manufacture, or the expiration of a guaranty period, indicated as such. (Option: This may be shown on the individual cell container, provided the jacket is removable.) Socket terminals shall be located on the top of the battery, and the polarity shall be clearly marked.

9. Top Closure for Cells and Batteries

9.1. Sealing compound used for closing cells and batteries at the top shall be insulating compound that will not flow at a temperature of 45° C (113° F) during a static test, in which the sealed surface is held vertical for a period of 24 hours.

9.2. Metal or composition covers for tops of cells may be used in lieu of sealing compound, provided such covers and accessory parts shall not become adversely affected by leakage, corrosion, or deformation during the useful life of the cell. Metal covers shall be insulated from at least one electrode.

9.3. Metal boxes and covers for assembled batteries shall, unless otherwise specified, be insulated from the cells comprising the battery. The top closing means may be metal, fiber, paperboard, sealing compound, or plastic.

10. Battery Connections

10.1. In all assembled batteries, electrical connections between cells and between cells and terminals shall be secure and permanent.

10.2. All soldered connections shall be made in such a manner as not to interfere with subsequent battery performance.

10.3. Welded or solderless wrapped connections, where practicable, may be used in lieu of soldered connections, provided they are equally permanent.

11. Terminals

11.1. Terminals in common use for batteries of various classifications are as follows:

(a) KNURLED-NUT AND SCREW TERMINALS. These shall have standard 8–32 threads, and shall be of brass or other suitable metal.

(b) SPRING-CLIP TERMINALS. These shall be of spring brass or other material of equivalent properties.

(c) FLASHLIGHT-CELL TERMINALS. In the case of flashlight cells, the metal cap on the carbon electrode and the bottom of the cell may serve as the terminals.

(d) FLAT- OR SPIRAL-SPRING TERMINALS. These terminals shall consist of either flat metal strips or spirally wound wire, in a form suitable to provide a pressure contact. They shall be made of spring brass, or other metal of equivalent properties.

(e) WIRE TERMINALS. These shall be flexible insulated tinned copper conductor and may be covered with single cotton braid or suitable plastic if so specified. The positive terminal wire covering shall be red and the negative, black. Unless otherwise specified, the size of wire shall be equivalent to No. 18 (AWG), and the length shall be 6 inches $\pm 1/2$ inch. When the free ends of wire terminals are stripped bare, the separate strands shall be soldered together at the tip. Under certain circumstances wire terminals may be required to terminate with a ring, open-ring, soldering lug, or other type of connector.

(f) "PLUG-IN" SOCKETS. This type of terminal shall consist of a suitable assembly of metal contacts, mounted in an insulating housing or holding device and adapted to receive corresponding pins of a mating plug in such manner as to make good electrical contact. The metal contacts shall be of tinned brass or other equally suitable metal. Dimensions and arrangement of socket contacts shall be in conformity with figures 1 to 4, inclusive, for various voltages as required and not exceeding 100 volts. For 300-volt batteries, such as the battery designated 200F20, the terminals shall be of the flush pin jack type with spacing and masking as shown in figure 8. These terminals are located on top of the battery on a center line through the sockets 9/16 inch from front of battery.

(g) SNAP-FASTENER TERMINALS. This type of terminal consists of a combination comprising a stud for the positive and a socket for the negative terminal, as illustrated in figure 5. These shall be made from tinned brass or other suitable metal. They shall be designed in such a way as to provide a secure electrical connection when fitted with corresponding parts for connection to an electrical circuit.

(h) FLAT CONTACT TERMINALS. These shall be essentially flat metal surface, as shown in figure 6, or as recommended in table 6, part II, adapted to make electrical contact by suitable contacting mechanisms bearing against them. In the subminiature hearing-aid B batteries, all flat terminals are projecting beyond the body of the battery, except in the case of the battery designated 15F15, where the flat terminals are recessed. This has been done to avoid any error in interchanging B battery and A battery (size AA) in a hearing-aid instrument.

11.2. *No. 6 Cells.* These shall be equipped with terminals of either the knurled-nut and screw type or with spring clips, as required. Spacing between centers of screw terminals shall be 1 1/16 inch ± 1/16 inch. In the case of spring-clip terminals the design and location of the negative terminal shall be such that no part of it will extend outside the periphery of the jacket when the connecting wire is in place.

11.3 *Assembled Batteries of No. 6 Cells* (*table 3*). These shall be equipped with terminals of either the knurled nut and screw, or spring-clip type, as required. Terminals shall be located on the top of the battery and the polarity of each shall be clearly marked.

11.4 *Group Batteries of Small Cells* (*table 4*). These batteries shall have terminals similar to those used on No. 6 dry cells.

11.5 *Flashlight Cells* (*table 5*). Terminals for these shall be as described in 11.1 (c). The positive terminal shall be centrally located at the top of the cell, and the negative shall be centrally located at the bottom. They shall be clean to assure good electrical contact.

11.6. *Lantern Batteries* (*table 5*). Terminals shall be of flat- or spiral-spring type brought out through the cover at the top. The point of contact of one terminal shall be at the center and that of the other 1 inch ±1/16 inch from it.

11.7. *Radio A, B, and C batteries and A/B Pack Batteries* (*tables 7, 8, 9, and 10*). Terminals for batteries in these classifications shall be as called for in the tables. They are located on top of the battery, except for the flat-contact type (XVI), which are on the top and bottom.

11.8. *Hearing-Aid Batteries*. Terminals for hearing-aid batteries shall be as called for in table 6 for the various sizes and voltages listed. They are located on top of the battery, except for the flashlight-cell type and the flat-contact type (XVI), which are on top and bottom. It is especially important in hearing-aid batteries that the terminals be such that good contact is maintained at all times with instrument terminals in order to avoid noise and unsatisfactory transmission, and they shall preferably be of such design that reversal of polarity of instrument terminals is impossible.

12. Voltage Tests

12.1. Voltage tests are intended to apply to fresh cells or batteries and shall be made within 30 days of receipt of samples by the testing agency. The batteries shall have been subjected to an ambient temperature of 21° C (70° F) for a long enough period (at least 24 hours) to have become stabilized at this temperature before the measurements are taken.

12.2. The voltmeter used shall meet the following requirements:

(*a*) The voltmeter shall have an accuracy of 0.5 percent of full-scale deflection. The resistance shall be 1,000 ohms per volt of full-scale deflection for cells larger than F20, and 10,000 ohms per volt or higher for cells of F20 size and smaller.

(b) When used to measure individual cells, the scale shall have not less than 50 divisions per volt.

(c) When used to measure batteries of two or more cells, the scale shall have not less than 100 divisions, and the full-scale reading shall preferably be about 2 volts per cell in series of the battery to be measured and shall not exceed 5 volts per cell in series.

13. Capacity Tests

13.1. The size and kind of dry cell or battery and the conditions of service determine the kind of test to be applied. The test that best represents any particular service is that which most nearly duplicates the rate-of-energy output of the battery when in actual use. Intermittent tests are preferred to continuous tests and shall be used wherever possible because there is no direct relation between the results of continuous tests and intermittent tests of longer duration, and they simulate service conditions more closely.

"Initial" tests intended to show the condition of fresh batteries shall be started within 30 days of the receipt of the batteries by the testing agency. All tests not otherwise designated shall be understood to be "initial" tests.

"Delayed" service tests are intended to measure the keeping quality of cells and batteries before use. Cells and batteries for delayed test shall have been stored on open circuit at an even temperature of 21° C (70° F) for the time specified before being subjected to the procedure for the test specified in the tables of requirements under section 14. The storage time specified shall be measured from the time when the batteries were received by the testing agency.

The standard temperature for tests is 21° C (70° F), unless otherwise specified. Deviations from this temperature shall be stated.

The resistance of the discharge circuit shall be maintained within 0.5 percent of its nominal value.

In making capacity tests on B and C batteries, readings of working voltage shall be taken with a voltmeter conforming to the requirements of paragraph 12.2.

To determine compliance with the specification in this Circular, those tests shall be applied for which requirement figures are given in tables 11 to 19, inclusive.

In the tests described below the frequency of readings specified for each test relates to the larger and more commonly used sizes of cells and batteries. When the smaller sizes are tested, more frequent readings are required.

13.2. *Description of Tests.*

(a) LIGHT INTERMITTENT TEST. Three cells connected in series shall be discharged through a resistance of 20 ohms for 10 periods of 4 minutes each, beginning at hourly intervals during 6 days per week. On the remaining day, every other discharge period shall be omitted. (There are 65 such discharge periods per week, or a total weekly service of 260 minutes.)

The following readings shall be taken: Initial open-circuit voltage of the battery; initial closed-circuit voltage of the battery; closed-circuit voltage at the end of the 10th discharge of each succeeding 7th day.

The test shall be continued until the closed-circuit voltage of the battery falls below 2.8 volts. The service shall be reported as the total number of days on test before battery potential falls below 2.8 volts.

(b) FIFTY-OHM TELEPHONE TEST. This test shall be conducted exactly as called for in section (a) above, except that the three cells shall be discharged through 50 instead of 20 ohms, and the cutoff voltage shall be 3.25 instead of 2.8 volts.

(c) HEAVY INTERMITTENT TEST. The battery shall be discharged through a resistance of 2⅔ ohms for each cell in series for two periods of 1 hour each daily according to the following schedule:

1-hour discharge. 6-hour rest. 1-hour discharge. 16-hour rest.

The following readings shall be taken: Initial open-circuit voltage of the battery; initial closed-circuit voltage of the battery; closed-circuit voltage every alternate working day thereafter at the end of the second discharge period of the day.

The test shall be continued until the closed-circuit voltage of the battery falls below 0.85 volt per cell. The service shall be reported as the total number of hours of actual discharge before battery potential falls below 0.85 volt per cell.

(d) GENERAL-PURPOSE 5-OHM INTERMITTENT TEST. Each cell shall be discharged through a resistance of 5 ohms for 5-minute periods at 24-hour intervals.

The following readings shall be taken: Initial open-circuit voltage of the cell; initial closed-circuit voltage of the cell; closed-circuit voltage of the cell at the end of a discharge period twice each week thereafter.

The test shall be continued until the closed-circuit voltage of the cell falls below 0.75 volt. The service shall be reported as the total number of minutes of actual discharge before cell potential falls below 0.75 volt.

(e) GENERAL-PURPOSE 4-OHM INTERMITTENT TEST. Each cell shall be discharged through a resistance of 4 ohms for 5-minute periods at 24-hour intervals.

The following readings shall be taken: Initial open-circuit voltage of the cell; initial closed-circuit voltage of the cell; closed-circuit voltage of the cell at the end of a discharge period twice each week thereafter.

The test shall be continued until the closed-circuit voltage of the cell falls below 0.75 volt. The service shall be reported as the total number of minutes of actual discharge before cell potential falls below 0.75 volt.

(f) GENERAL-PURPOSE 2.25-OHM INTERMITTENT TEST. Each cell shall be discharged through a resistance of 2.25 ohms for 5-minute periods at 24-hour intervals.

The following readings shall be taken: Initial open-circuit voltage of the cell; initial closed-circuit voltage of the cell; closed-circuit voltage of the cell at the end of a discharge period twice each week thereafter.

The test shall be continued until the closed-circuit voltage of the cell falls below 0.65 volt. The service shall be reported as the total number of minutes of actual discharge before cell potential falls below 0.65 volt.

(g) LIGHT-INDUSTRIAL FLASHLIGHT TEST. Each cell shall be discharged through a resistance of 4 ohms for 4-minute periods, beginning at hourly intervals for 8 consecutive hours every day, with 16-hour rest periods intervening. (There are eight such discharge periods each day, or a total daily discharge of 32 minutes.)

The following readings shall be taken: Initial open-circuit voltage of the cell; initial closed-circuit voltage of the cell; closed-circuit voltage of the cell daily at the end of the last discharge period.

The test shall be continued until the closed-circuit voltage of the cell falls below 0.90 volt. The service of general-purpose flashlight cells shall be reported as the total number of minutes of actual discharge before cell potential falls below 0.90 volt. The service of industrial flashlight cells shall be reported as the total number of minutes of actual discharge before cell potential falls below 1.10 and 0.90 volt.

(h) HEAVY-INDUSTRIAL FLASHLIGHT TEST. Each cell shall be discharged through a resistance of 4 ohms for 4-minute periods, beginning at 15-minute intervals, for 8 consecutive hours every day, with 16-hour rest periods intervening. (There are 32 such discharge periods each day, or a total daily discharge of 128 minutes.

The following readings shall be taken: Initial open-circuit voltage of the cell; initial closed-circuit voltage of the cell; closed-circuit voltage of the cell at the end of the 16th and 32d discharge periods daily.

The test shall be continued until the closed-circuit voltage of the cell falls below 0.90 volt. The service shall be reported as the total number of minutes of actual discharge before cell potential falls below 1.10 and 0.90 volts.

(i) PHOTOFLASH TEST. Each cell shall be discharged through a resistance of 0.15 ohm for 1 second each minute for 1 hour (one discharge per minute) at 24-hour intervals for 5 consecutive days each week.

The following readings shall be taken: Initial open-circuit voltage of the cell; closed-circuit voltage of the cell on discharge the 1st, 30th, and 60th minute daily.

The test shall be continued until the closed-circuit voltage of the cell falls below 0.5 volt for the D size cell and 0.25 volt for the AA and C size cells. The service shall be reported as the total number of seconds of actual discharge before cell potential falls below 0.5 and 0.25 volt.

(j) RAILROAD-LANTERN BATTERY TEST. The battery shall be discharged every day during 8 periods of 30 minutes each, beginning at intervals of 1 hour for 8 consecutive hours, through a resistance of 8 ohms for each cell in series in the battery.

The following readings shall be taken: Initial open-circuit voltage of the battery; initial closed-circuit voltage of the battery; closed-circuit voltage of the battery daily, thereafter at the end of the last period of discharge for the day.

The test shall be continued until the closed-circuit voltage of the battery falls below 0.90 volt per cell. The service shall be reported as the total number of hours of actual discharge before battery potential falls below 0.90 volt per cell.

(k) HEARING-AID A-BATTERY TEST, 20 OHMS. The battery shall be discharged through a resistance of 20 ohms for each cell in series in the battery, for one continuous 12-hour period each day.

The following readings shall be taken: Initial open-circuit voltage; initial closed-circuit voltage; closed-circuit voltage at the end of each 12-hour period of discharge, with readings during the discharge period, if necessary, to determine accurately the end of the test.

The test shall be continued until the closed-circuit voltage falls below 0.90 volt per cell. The service shall be reported as the total number of hours of actual discharge before battery potential falls below 0.90 volt per cell.

(l) HEARING-AID A-BATTERY TEST, 30 OHMS. This test shall be as specified in paragraph (k) of section 13.2, with the exception that 30 ohms shall be used in place of 20 ohms.

(m) HEARING-AID A-BATTERY TEST, 50 OHMS. This test shall be as specified in paragraph (k) of section 13.2, with the exception that 50 ohms shall be used in place of 20 ohms.

(n) HEAVY HEARING-AID B-BATTERY TEST, 1,500 OHMS. The battery shall be discharged through a resistance of 1,500 ohms for each cell in series in the battery for one continuous 12-hour period each day. The following readings shall be taken: Initial open-circuit voltage; initial closed-circuit voltage; closed-circuit voltage at the end of each discharge period.

The test shall be continued until closed-circuit voltage falls below 1.0 volt per cell. The service shall be reported as the total number of hours of actual discharge before battery potential falls below 1.0 volt per cell.

(o) LIGHT HEARING-AID B-BATTERY TEST, 3,000 OHMS. The battery shall be discharged through a resistance of 3,000 ohms for each cell in series in the battery for one continuous 12-hour period each day.

The following readings shall be taken: Initial open-circuit voltage; initial closed-circuit voltage; closed-circuit voltage at the end of each discharge period.

The test shall be continued until closed-circuit voltage falls below 1.0 volt per cell. The service shall be reported as the total number of hours of actual discharge before battery potential falls below 1.0 volt per cell.

(p) SPECIAL LIGHT HEARING-AID B-BATTERY TEST, 6,000 OHMS. This test shall be as specified in paragraph (o) above, with the exception that 6,000 ohms shall be used in place of 3,000 ohms.

(q) 5-OHM A-BATTERY TEST. Each complete 1½-volt battery shall be discharged through a resistance of 5 ohms, during a continuous period of 4 hours daily.

The following readings shall be taken: Initial open-circuit voltage; initial closed-circuit voltage; closed-circuit voltage at the end of alternate discharge periods.

The test shall be continued until the closed-circuit voltage falls below 1.0 volt. The service shall be reported as the total number of hours of actual discharge before battery potential falls below 1.1 and 1.0 volts.

(r) 25-OHM A-BATTERY TEST. Each complete battery shall be discharged through a resistance of 25 ohms for each 1½ volts of nominal battery voltage during a continuous period of 4 hours daily.

The following readings shall be taken: Initial open-circuit voltage; initial closed-circuit voltage; closed-circuit voltage at the end of alternate discharge periods.

The test shall be continued until the closed-circuit voltage falls below 1.0 volt per cell in series in the battery. The service shall be reported as the total number of hours of actual discharge before battery potential falls below 1.1 and 1.0 volts per cell.

(s) 22,500-OHM INTERMITTENT TEST. Each 22½-volt (nominal voltage) battery unit shall be discharged through a resistance of 22,500 ohms during a continuous period of 4 hours daily, the intervals between successive discharge periods being not less than 16 hours.

The following readings shall be taken: Initial open-circuit voltage of the battery; initial closed-circuit voltage of the battery; closed-circuit voltage at the end of alternate discharge periods.

The test shall be continued until the closed-circuit voltage falls below 15 volts. The service shall be reported as the total number of hours of actual discharge before battery potential falls below 15 volts.

(t) 2,500-OHM INTERMITTENT TEST. This test shall be as specified in paragraph (s) above, with the exception that 2,500 ohms shall be used in place of 22,500 ohms.

(u) 1,250-OHM INTERMITTENT TEST. This test shall be as specified in paragraph (s) above, with the exception that 1,250 ohms shall be used in place of 22,500 ohms.

(v) C-BATTERY TEST. The C batteries shall be stored on open circuit at an even temperature of approximately 21° C (70° F), and voltage readings shall be taken at intervals of not exceeding 1 month.

The test shall be continued until the open-circuit voltage falls below 1.45 volts per cell. The service shall be reported as the number of months before battery potential falls below 1.45 volts per cell.

(w) A/B PACK BATTERY TESTS. A/B-pack batteries shall be subjected to the same test for their A and B sections as are applicable, respectively, to separate A and B batteries of the same cell sizes. The service shall be reported as the total number of hours of actual discharge before battery potential falls below 1.0 volt per cell in series for the A section or below 15 volts per 22½-volt unit for the B section, whichever is the smaller number.

14. Required Performance

Batteries and cells of the various types and sizes shall comply with the performance requirements listed in tables 11 to 19, inclusive, as indicated below:

		Table
(a)	No. 6 dry cells and telephone cells	11
(b)	Group batteries of small cells intended as equivalent to No. 6 cells shall meet the requirements shown for the corresponding type of No. 6 cells in	11
(c)	General-purpose flashlight cells	12
(d)	Industrial flashlight cells and batteries	13
(e)	Photoflash cells	14
(f)	Hearing-aid batteries	15
(g)	A batteries	16
(h)	B batteries	17
(i)	C batteries	18
(j)	A/B-pack batteries	19

TABLE 11. *No. 6 dry cells and cells for telephone applications*

Sizes and types	Light intermittent test	50-ohm telephone test	Heavy intermittent test	
			Initial	6-month delayed
	Days	*Days*	*Hours*	*Hours*
No. 6 general purpose [a]	200	------	70	65
No. 6 industrial [b]	310	500	100	90
No. 6 "Special" telephone [c]	340	625	------	------
No. 6 "Regular" telephone [c]	300	470	------	------
Size D telephone	30	60	------	------

[a] Cells not otherwise specifically marked or represented by the manufacturer shall be considered as general purpose cells and tested according to the requirements thereof.

[b] This type of cell is intended for applications where highly efficient performance is required on both heavy and light services.

[c] No requirements are shown for telephone cells on heavy intermittent test as these types are not usually intended for heavy service.

Table 12. *General-purpose flashlight cells*

Cell designation	General-purpose 2.25-ohm intermittent test		General-purpose 4-ohm intermittent test		General-purpose 5-ohm intermittent test		Light-industrial test
	Initial	6-month delayed	Initial	6-month delayed	Initial	6-month delayed	
	Minutes	*Minutes*	*Minutes*	*Minutes*	*Minutes*	*Minutes*	*Minutes*
D	400	375	675	625	------	------	600
C	------	------	325	275	------	------	------
AA	------	------	80	65	------	------	------
AAA	------	------	------	------	45	25	------

Table 13. *Industrial flashlight cells and batteries*

Type designation	Heavy-industrial test				Light-industrial test				Railroad-lantern test	
	Initial		3-month delayed		Initial		3-month delayed		Initial	6-month delayed
	1.1 volts	0.9 volt	1.1 volts	0.9 volt	1.1 volts	0.9 volt	1.1 volts	0.9 volt		
	Minutes	*Minutes*	*Minutes*	*Minutes*	*Minutes*	*Minutes*	*Minutes*	*Minutes*	*Hours*	*Hours*
D, heavy-industrial	300	750	200	650	---	---	---	---	---	---
D, light-industrial	---	---	---	---	550	850	450	750	---	---
4F, railroad lantern	---	---	---	---	---	---	---	---	45	40

Table 14. *Photoflash cells*

Cell designation	0.15-ohm intermittent test	
	Initial	6-month delayed
	Seconds	*Seconds*
D	800	650
C	700	550
AA	150	120

TABLE 15. *Hearing-aid batteries*

PART I. A BATTERIES

Classification and type designation		20-ohm intermittent test		30-ohm intermittent test		50-ohm intermittent test	
Cylindrical	Flat	Initial	6-month delayed	Initial	6-month delayed	Initial	6-month delayed
		Hours	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*
AA	------	------	------	10	8	30	25
AA2	------	15	10	35	25	75	60
A	------	8	7	18	16	45	40
C	------	15	10	35	25	------	------
CL	------	35	30	70	60	------	------
CD	------	70	65	130	120	------	------
D	------	70	65	130	120	------	------
F	------	120	110	220	200	------	------
M1[a]	------	------	------	25	20	45	40
M3[a]	------	------	------	50	45	100	90
M4[a]	------	50	40	80	70	130	120
MAA[a]	------	35	30	60	50	100	90
MA[a]	------	60	50	90	80	150	140
MAA2[a]	------	90	80	140	130	175	160

PART II. B BATTERIES

		1,500-ohm intermittent test		3,000-ohm intermittent test		6,000-ohm intermittent tent	
		Initial	6-month delayed	Initial	6-month delayed	Initial	6-month delayed
		Hours	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*
------ ------ ------ ------	10F15 15F15 20F15s 20F15d	------	------	125	[b]100	250	[b]200
------ ------ ------	10F20 15F20 20F20	100	[b]90	200	[b]175	400	[b]350
10NS 15NS 20NS	10F30 15F30 20F30	300	250	600	500	------	------
15N 22N 30N	15F40 22F40 30F40	525	475	950	900	------	------

PART III. BATTERIES FOR CARBON-TYPE INSTRUMENTS

		20-ohm intermittent test	
		Initial	6-month delayed
		Hours	*Hours*
2CD, 3CD	------	70	65

[a]M = Mercury-type cell or equivalent size.
[b]Three-month delayed test.

Table 16. *A batteries*

Battery designation	5-ohm A-battery test				25-ohm A-battery test			
	Initial		6-month delayed		Initial		6-month delayed	
	1.1 volts	1.0 volt	1.1 volts	1.0 volt	1.1 volts [a]	1.0 volt [a]	1.1 volts [a]	1.0 volt [a]
	Hours	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*
F2	30	35	26	30	-----	-----	-----	-----
F4d	90	115	85	110	-----	-----	-----	-----
F6d	140	170	135	165	-----	-----	-----	-----
F8d	190	235	185	230	-----	-----	-----	-----
3D	-----	-----	-----	-----	50	70	40	60
3F, 4Fd	-----	-----	-----	-----	120	140	110	130
4F2s	-----	-----	-----	-----	240	325	230	310
3G	-----	-----	-----	-----	140	170	130	160

[a]Cutoff voltage stated as volts per cell or 1½-volt group in series.

Table 17. *B batteries*

Battery designation		Test to be applied for 22½-volt unit	Initial test [a]	6-month delayed test [a]
Cylindrical	Flat			
			Hours	*Hours*
------------	15F20, 20F20	22,500-ohm intermittent	100	90 [b]
15NS, 30NS, 45NS	15F30, 30F30, 45F30	do	300	250
30N, 45N, 60N	30F40, 45F40, 60F40	do	525	475
30N, 45N, 60N	30F40, 45F40, 60F40	2,500-ohm intermittent	30	25
30AA	30F70	do	75	60
15A, 30A	15F80, 30F80	do	130	120
30BR	------------	do	160	140
15B, 30B	30F90	do	225	210
30D	30F100	do	600	560
30F	------------	1,250-ohm intermittent	550	500
30G	------------	do	600	550

[a]To 15 volts for each 22½-volt unit.
[b]Three-month delayed test.

Table 18. *C batteries*

Battery designation	C-battery test
	Months
3B, 5B, 15B	24
3D	36
200F20	[a] 12

[a] Open-circuit voltage measurements to be made with a voltmeter having a resistance of 10,000 ohms per volt or higher.

Table 19. *A/B pack batteries*

Battery designation	Test to be applied	Initial test	6-month delayed test
		Hours [a]	*Hours* [a]
60AA/6CD	A. 25-ohm A-battery test B. 2,500-ohm intermittent	75	65
60A/6F	A. 25-ohm A-battery test B. 2,500-ohm intermittent	130	120
60BR/6G	A. 25-ohm A-battery test B. 2,500-ohm intermittent	160	140
60D/F18	A. 5-ohm A-battery test B. 2,500-ohm intermittent	600	560

[a] To 1.0 volt for each 1½ volts of nominal A-battery voltage and to 15 volts for each nominal 22½ volts of B battery.

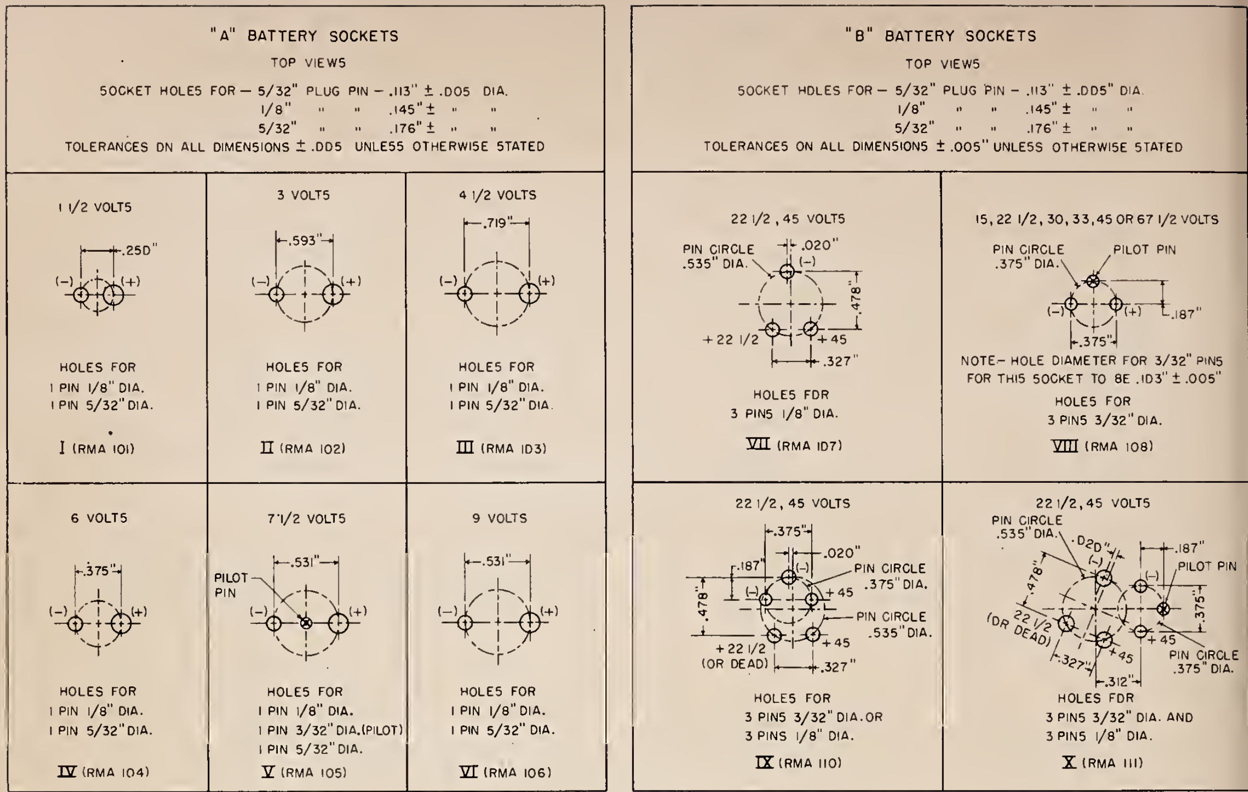


FIGURE 1.

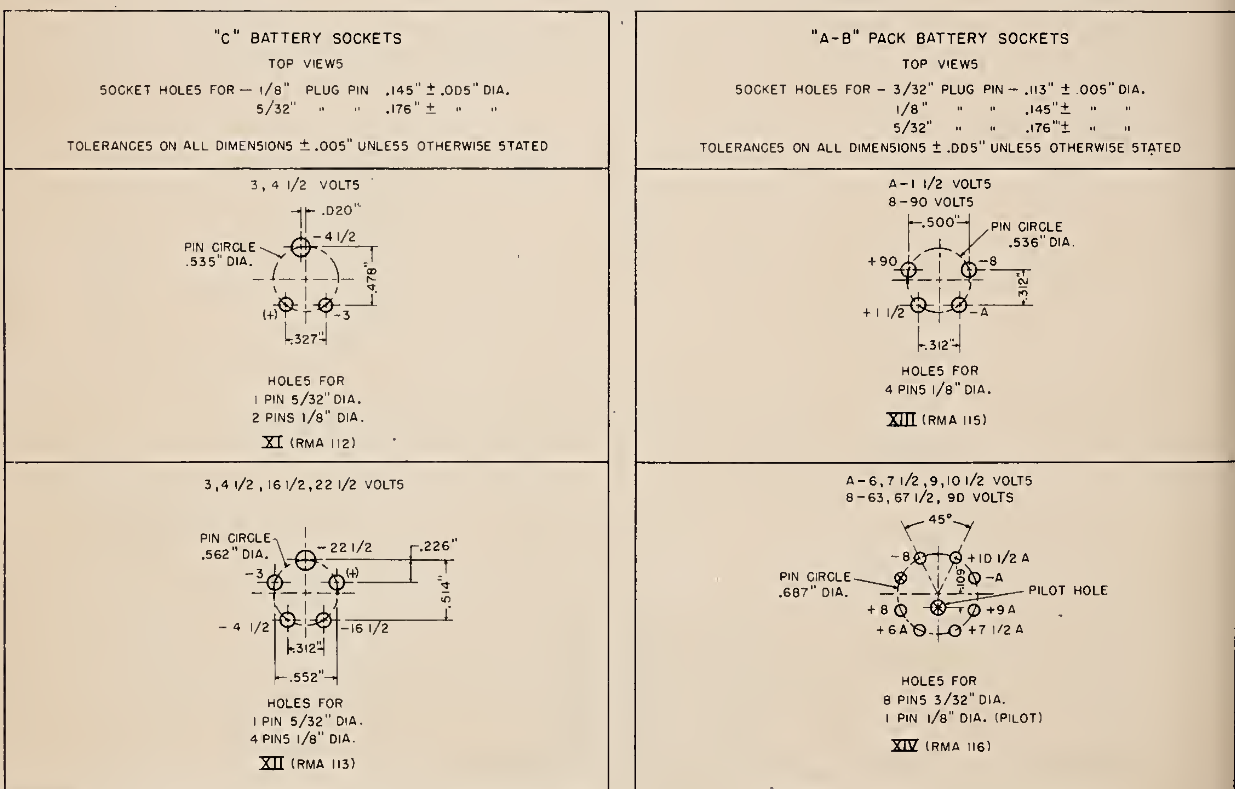
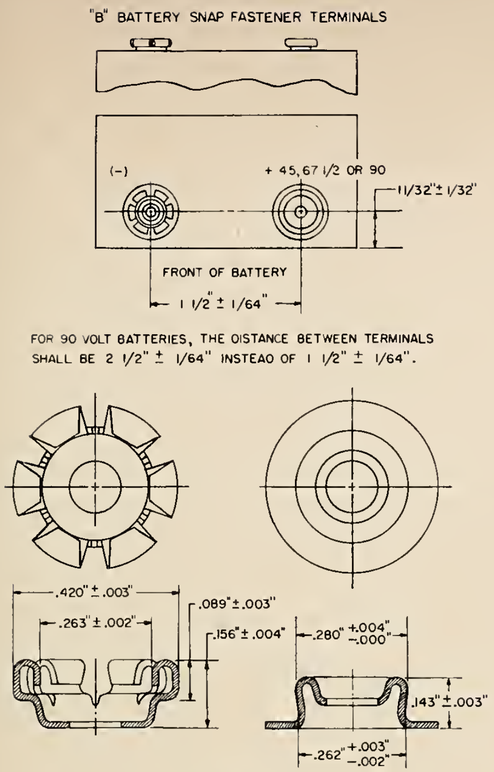
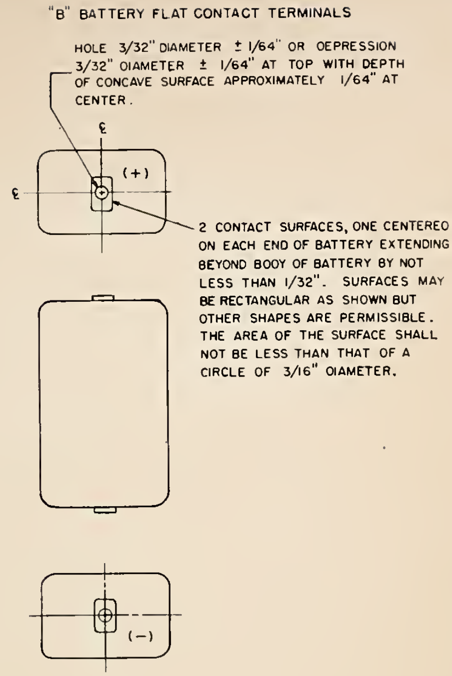


FIGURE 2.



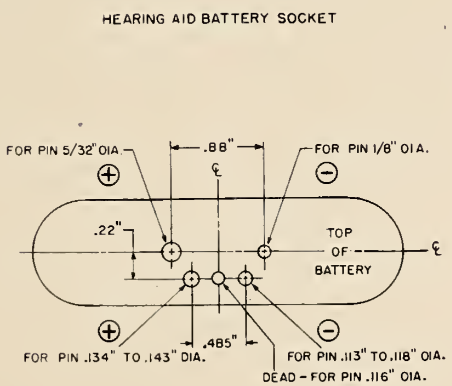
XV (RMA 119)

FIGURE 3.

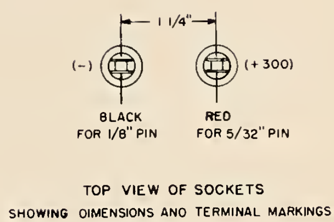


XVI (MODIFIED RMA 120)

FIGURE 4.



XVII (RMA 121)



XVIII

FIGURE 5.

WASHINGTON, October 14, 1954.

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