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UNITED STATES GOVERNMENT SPECIFICATION FOR
DRY CELLS.

FEDERAL SPECIFICATIONS BOARD.

STANDARD SPECIFICATION NO. 58.

This specification was officially adopted by the Federal Specifications Board on June 15, 1923, for the use of the Departments and Independent Establishments of the Government in the purchase of dry cells.

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1. DEFINITIONS.

(a) Dry cells to be included under these specifications shall fulfill the following requirements in addition to the other paragraphs of these specifications:

(1) To be sal ammoniac cells with depolarizer.

(2) To have a nonspillable electrolyte and to be free from leakage during the useful life of the cell.

(b) Desiccated cells to which water must be added before the cell is put into service may be included under these specifications.

2. TYPES OF CELLS.

The following types of dry cells will be considered in these specifications:

- (a) Telephone or light-service cells.
- (b) General purpose cells.
- (c) Ignition or heavy-service cells.
- (d) Flash-light cells and batteries.
- (e) Assembled batteries, exclusive of class (d).
- (f) Desiccated cells and other similar cells to which water must be added.
- (g) "B" batteries for radio service.

3. SIZES OF CELLS.

(a) STANDARD SIZES, IGNITION, TELEPHONE, AND SIMILAR CELLS, CYLINDRICAL FORM.—These dimensions are for the zinc container of the cell and are to be measured on the cell without the carton.

TABLE 1.

Diameter.	Height.	Diameter.	Height.
Inches.	Inches.	cm	cm
1½	4	4	10
2½	6	6.5	15

Deviations shall not exceed $\frac{1}{16}$ inch in diameter and $\frac{1}{8}$ inch in height from the dimensions as given in inches. The cells are to be of the flush-top type. Terminals shall not add more than $\frac{5}{8}$ inch (1.6 cm) to the height of the cells as given above. The maximum diameter of the cells measured over the carton shall not exceed the diameter as given above by more than $\frac{1}{8}$ inch (3 mm).

(b) STANDARD SIZES, FLASH-LIGHT CELLS, CYLINDRICAL FORM.—These dimensions are for the zinc container of the cell.

TABLE 2.

Diameter.	Height.	Diameter.	Height.
Inches.	Inches.	cm	cm
¾	1½	1.6	4.8
^a ¾	2½	1.9	5.4
1¼	1¾	2.4	4.6
1½	2¼	3.2	5.7
1¾	2½	3.2	7.3

^a Provisionally included in table.

Deviations from these dimensions, as given in inches, shall not exceed $\frac{1}{16}$ inch in height or $\frac{1}{32}$ inch in diameter. The height, including cap on carbon rod, shall not exceed the height given in Table 2 by more than $\frac{1}{8}$ inch (3 mm).

(c) FLASH-LIGHT BATTERIES, STANDARD SIZES.—These batteries contain cells of standard sizes as given above. The batteries are listed in the following table. Deviations from these dimensions, as given in inches, shall not exceed $\frac{1}{16}$ inch in height per cell, or $\frac{1}{32}$ inch in diameter for tubular batteries; nor $\frac{1}{16}$ inch in height or $\frac{1}{32}$ inch per cell in width, and $\frac{1}{32}$ inch in depth for flat or box batteries.

TABLE 3.

Kind.	No. of cells.	Size of cells.				Dimensions of battery.					
		Diameter.	Height.	Diameter.	Height.	Width or diameter.	Height.	Depth.	Width or diameter.	Height.	Depth.
Unit cell.....	1	$1\frac{1}{4}$	$2\frac{1}{4}$	3.2	5.7	$1\frac{3}{8}$	$2\frac{3}{8}$	.....	3.3	5.9	.....
	1	$1\frac{1}{4}$	$1\frac{1}{4}$	2.4	4.6	1	$1\frac{7}{8}$	.....	2.5	4.8	.....
Tubular.....	3	$1\frac{1}{4}$	$2\frac{1}{4}$	3.2	5.7	$1\frac{3}{8}$	7	.....	3.3	17.8	.....
	2	$1\frac{1}{4}$	$2\frac{1}{4}$	3.2	5.7	$1\frac{3}{8}$	$4\frac{1}{4}$	.....	3.3	11.9	.....
	2	$1\frac{1}{4}$	$1\frac{1}{4}$	2.4	4.6	1	$3\frac{3}{4}$	.....	2.5	9.5	.....
Flat.....	^a 3	$\frac{5}{8}$	$2\frac{1}{8}$	1.9	5.4	$2\frac{7}{8}$	$2\frac{1}{2}$	$\frac{1}{4}$	6.2	6.3	2.1
	3	$\frac{5}{8}$	$1\frac{1}{8}$	1.6	4.8	2	$2\frac{1}{4}$	$\frac{1}{4}$	5.1	5.7	1.75
	2	$\frac{5}{8}$	$1\frac{1}{8}$	1.6	4.8	$1\frac{3}{8}$	$2\frac{1}{4}$	$\frac{1}{4}$	3.3	5.7	1.75
Box.....	3	$1\frac{1}{4}$	$2\frac{1}{8}$	3.2	7.3	$3\frac{3}{8}$	$3\frac{1}{8}$	$1\frac{1}{8}$	9.8	7.8	3.3

^a Provisionally included in table.

(d) ASSEMBLED BATTERIES.—The individual cells in these batteries shall conform to these specifications, with the exception that the cartons may be omitted, other insulation between the cells being provided. The cells in these batteries are to be $2\frac{1}{2}$ inches in diameter by 6 inches in height.

TABLE 4.—Standard Sizes of Assembled Batteries.

[These batteries contain No. 6 cells. The dimensions given are the maximum.]

Assembly.	Voltage.	Length.	Width.	Height.	Weight.	Length.	Width.	Height.	Weight.
	Volts.	Inches.	Inches.	Inches.	Pounds.	cm	cm	cm	kg
2 cells, single row.....	3	$5\frac{1}{8}$	$2\frac{3}{4}$	$7\frac{1}{2}$	5	13	7	19	2.3
4 cells, single row.....	6	$10\frac{5}{8}$	$2\frac{3}{4}$	$7\frac{1}{2}$	$10\frac{1}{2}$	27	7	19	4.8
4 cells, double row.....	6	$5\frac{3}{8}$	$5\frac{3}{8}$	$7\frac{1}{2}$	$10\frac{1}{2}$	13.7	13.7	19	4.8
5 cells, single row.....	$7\frac{1}{2}$	$13\frac{3}{4}$	$2\frac{3}{4}$	$7\frac{1}{2}$	13	33.7	7	19	5.9
5 cells, double row.....	$7\frac{1}{2}$	8	$5\frac{3}{8}$	$7\frac{1}{2}$	13	20.3	13.7	19	5.9
6 cells, double row.....	9	8	$5\frac{3}{8}$	$7\frac{1}{2}$	16	20.3	13.7	19	7.3

The height given is the maximum height over all. The body of the battery will be $6\frac{1}{2}$ to 7 inches in height.

(e) STANDARD SIZES, "B" BATTERIES FOR RADIO SERVICE.—These batteries contain cells of standard sizes as shown in Table 5. The cells are to be connected in series.

TABLE 5.—"B" Batteries for Radio Service.

Assembly.	No. of cells.	Size of cells.				Dimensions of battery.					
		Diameter.	Height.	Diameter.	Height.	Length.	Height.	Width.	Length.	Height.	Width.
Rectangular box.....	15	Inches. $\frac{5}{8}$	Inches. $1\frac{1}{8}$	cm 1.6	cm 4.8	Inches. $3\frac{3}{8}$	Inches. $2\frac{2}{5}$	Inches. $2\frac{1}{5}$	cm 8.6	cm 6.5	cm 5.2
Rectangular box.....	15	$1\frac{1}{4}$	$2\frac{1}{4}$	3.2	5.7	$6\frac{5}{8}$	3	4	16.8	7.6	10.2

Deviations from these dimensions as given in inches shall not exceed the following:

Smaller battery, $\frac{1}{16}$ inch in length, width, or height.

Larger battery, $\frac{1}{8}$ inch in length, $\frac{1}{16}$ inch in width or height.

4. CARTON.

The individual cells, except those in assembled batteries, flashlight batteries, and radio batteries, shall be inclosed in a close-fitting carton of news, chip, or strawboard. Paraffined or waxed cartons may be required for special purposes. On the outside of the carton shall be printed the following information:

The trade name of the cell.

Its number or other designation of size.

The date of manufacture or the expiration of a guaranty period. (Optional: This may be on zinc container.)

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

Any necessary directions as in the case of desiccated cells.

5. ZINC CAN.

The zinc can serves as a container for the cell and as the anode. It is to be made from smooth sheet zinc, free from flaws, blisters, and cracks.

6. SEALING COMPOUND.

The sealing compound shall be an insulating material which shall not cold flow at a temperature of 45° C. (113° F.) during a static test of 24 hours' duration.

7. TERMINALS AND CELL CONNECTIONS.

(a) LARGE SINGLE CELLS (TABLE 1).—The terminals are to be of brass of the knurled nut and screw type (thread 8-32). Spring clips are to be furnished when specified. The terminals shall not be obstructed by the cardboard carton or protruding material of the seal.

(b) FLASH-LIGHT SINGLE CELLS (TABLE 2).—The brass cap on the carbon rod and the zinc bottom of the cell serve as the terminals.

(c) FLASH-LIGHT BATTERIES (TABLE 3).—*Tubular batteries.*—The cells in these batteries are of the flush-top type assembled end to end. The brass cap on carbon rod of the top cell is one terminal, the other terminal being the zinc bottom of the lowest cell.

Flat batteries.—The cells in these batteries are to be assembled side by side with soldered connections. The terminals of the batteries are to be of spring brass, soldered to the cells.

Box batteries.—The cells in these batteries are to be assembled side by side with soldered connections. The terminals of the batteries are to be of spring brass brought out from top of the battery on the same side $2\frac{1}{2}$ inches apart from center to center.

(d) ASSEMBLED BATTERIES (TABLE 4).—The batteries are to have soldered connections between the individual cells. The terminals are to be brought through the top of case or sealing material to binding posts. The polarity of the terminals is to be marked.

(e) "B" BATTERIES FOR RADIO SERVICE (TABLE 5).—These batteries are to have soldered connections between the individual cells. The two end cells of the series are to be at diagonally opposite corners of the battery. The terminal leads of the battery are to consist of stranded copper conductor equivalent to No. 18 B. & S. gauge. The terminal wires are to be rubber-insulated, covered with single cotton braid. The positive lead is to have a red braid and the negative lead a black braid. The leads are to be 6 inches long to within one-half inch. The free ends of the leads shall be bared for a distance of one-half inch and the strands twisted and soldered together. The bared ends are to be insulated before shipment to prevent short circuits. The use of tinned copper conductors for the leads and the use of intermediate taps and the other forms of terminals are optional.

8. VOLTAGE.

The voltage of individual cells shall be not less than the values shown in Table 6 for the corresponding sizes of cells when measured with a voltmeter having a resistance of not less than 100 ohms per volt and having not less than 50 divisions per volt of its scale.

The voltage of batteries of two or more cells shall be not less than the product of the required minimum voltage per cell by the number of cells in the battery when measured with a voltmeter of equal quality having a range that provides at least 25 divisions for the nominal voltage which is to be measured.

TABLE 6.

Size of cell.		Minimum voltage.
Diameter.	Height.	
Inches.	Inches.	
2½	6	1.50
1½	4	1.50
1¼	2⅞	1.50
1¼	2¼	1.50
1⅜	1⅜	1.49
¾	2½	1.48
⅝	1⅞	1.47

9. TESTS.

Details concerning the apparatus and methods used in making the various tests on dry cells and batteries covered by these specifications may be found in the current edition of Circular No. 79 of the Bureau of Standards on Electrical Characteristics and Testing of Dry Cells.

The size and kind of dry cell or the conditions of service will determine the kind of test to be applied. Cells are to be free from leaks during the period of test. The standard temperature for tests is 20° C. The tests ordinarily made are as follows:

(a) INTERMITTENT TESTS.—(1) *Light intermittent service*.—Three cells connected in series are discharged through 20-ohms resistance for 10 periods of 4 minutes each at hourly intervals during 6 days per week. On the remaining day every other discharge period is omitted. (There are 65 such discharge periods per week, or a total weekly service of 260 minutes.)

The following readings will be taken:

Initial open-circuit voltage of the battery.

Initial closed-circuit voltage of the battery.

The closed-circuit voltage at the end of a discharge, after 7 days, and every 7 days thereafter until the voltage falls below 3.5 volts, following which the readings are to be taken daily.

The test is considered finished when the working voltage of the battery has fallen below 2.8 volts. The service is reported as the total days on test to this cut-off voltage.

The test should be started so that the readings will be made on a day having 10 discharge periods and, if possible, the voltage reading should be taken at the end of the last discharge period for the day.

(2) *Heavy intermittent service.*—Four cells, connected in series, are discharged through $10\frac{2}{3}$ -ohms resistance for two periods of 1 hour each daily; the discharge periods are to be not less than 6 hours apart.

The following readings will be taken:

Initial open-circuit voltage of the battery.

Initial closed-circuit or working voltage.

Closed-circuit voltage every other day thereafter at the end of the second period.

The test is considered completed when the closed-circuit voltage at the end of a period of discharge falls below 0.85 volt per cell. The test is reported as the hours of actual discharge to the cut-off voltage.

(3) *Flash-light test.*—The battery is discharged for 5-minute periods, at 24-hour intervals, through a resistance of 4 ohms for each cell in series in the battery. The following readings will be taken:

Initial open-circuit voltage of battery.

Initial closed-circuit voltage of battery.

Closed-circuit voltage of battery twice each week thereafter at the end of a discharge period.

The test is considered finished when the closed-circuit voltage at the end of a period of discharge falls below 0.5 volt per cell.

The result is reported as the total minutes of discharge to the cut-off voltage.

(b) CONTINUOUS-DISCHARGE TEST.—Intermittent tests are to be preferred to continuous tests. "B" batteries for radio service, however, are regularly tested by continuous discharge as specified.

(1) *10-ohm continuous test.*—Cells listed in Table 1 or batteries listed in Table 4 are discharged continuously through a resistance of 10 ohms per cell until the closed-circuit voltage of the battery has fallen below 0.75 volt per cell.

The following readings will be taken

Initial open-circuit voltage.

Initial closed-circuit voltage.

Readings daily of the closed-circuit voltage thereafter to the cut-off voltage.

The result is reported as the number of hours duration of the discharge.

(2) *2.75-ohm continuous test.*—This test is for the flash-light cells and batteries listed in Tables 2 and 3. These are discharged continuously through a resistance of 2.75 ohms per cell until the closed-circuit voltage of the battery has fallen below 0.50 volt per cell.

The following readings will be taken:

Initial open-circuit voltage.

Initial closed-circuit voltage.

Closed-circuit voltages at half hourly intervals for the larger sizes and 10-minute intervals for the smaller sizes until the voltage drops to 0.55 volt per cell, after which the readings are required twice as often.

The result of this test is reported as the number of minutes duration of the discharge.

(3) *5,000-ohm continuous test.*—This test is for "B" batteries for radio service (Table 5). These are discharged continuously through 5,000 ohms per battery of 15 cells until the closed-circuit voltage of the battery has fallen below 17 volts.

The following readings will be taken:

Initial open-circuit voltage.

Initial closed-circuit voltage.

Closed-circuit voltages twice daily for the small size; similar readings daily for the large size.

The result of this test is reported as number of hours of discharge to the cut-off voltage.

(c) **NOISE TEST FOR "B" BATTERIES.**—A radio head set of not less than 2,000 ohms resistance in series with 20,000 ohms is to be connected to the battery terminals. The battery shall not produce noise in the head set when the battery is jarred.

(d) **SHELF TESTS.**—Shelf tests shall consist of keeping the cells on open circuit at an even temperature of approximately 20° C. (68° F.) over a period of time, depending on the size of the cell, during which measurements of voltage and short-circuit current will be made, or tests of electrical capacity, which are designated as delayed service tests in Table 8.

The procedure for making delayed service tests follows the continuous test described above.

10. PERFORMANCE.

TABLE 7.—Intermittent Tests.

Size of cell.		Test.	Minimum required performance. ¹
Diameter.	Height.		
Inches.	Inches.		
2½	6	Heavy intermittent service.....	40 hours.
1½	4	Light intermittent service.....	60 days.
2½	6	Light intermittent service.....	160 days. ²
5⁄8	17⁄8	Flash light.....	100 minutes.
3⁄4	23⁄8	Flash light.....	180 minutes.
1⁄8	11⁄8	Flash light.....	250 minutes.
1¼	2¼	Flash light.....	600 minutes.
1¼	23⁄8	Flash light.....	

¹ Within one month from date of manufacture.
² Allowance for depreciation after one month, 3 per cent per month.

TABLE 8.—Continuous and Delayed Service Tests.

Size of cell.		Test.	Minimum required performance.				
Diameter.	Height.		0 to 1 month.	3 months.	6 months.	9 months.	12 months.
Inches.	Inches.		Hours.	Hours.	Hours.	Hours.	Hours.
1½	4	10-ohm, single cell.....	60	56	54	47	.....
2½	6	10-ohm, single cell.....	185	180	175	165	155
5⁄8	17⁄8	5,000 ohms, "B" batteries.....	75	71	68	63	53
1¼	2¼	5,000 ohms, "B" batteries.....	760	740	710	670	590
			Min-utes.	Min-utes.	Min-utes.	Min-utes.	Min-utes.
5⁄8	17⁄8	2.75 ohms, flash-light batteries.....	55	49	44	.....	.....
3⁄4	23⁄8	2.75 ohms, flash-light batteries.....	110	100	90	75	.....
1⁄8	11⁄8	2.75 ohms, flash-light batteries.....	130	120	110	95	.....
1¼	2¼	2.75 ohms, flash-light batteries.....	500	470	445	420	375
1¼	23⁄8	2.75 ohms, flash-light batteries.....	600	560	540	510	450

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